THE MARINE REVIEW

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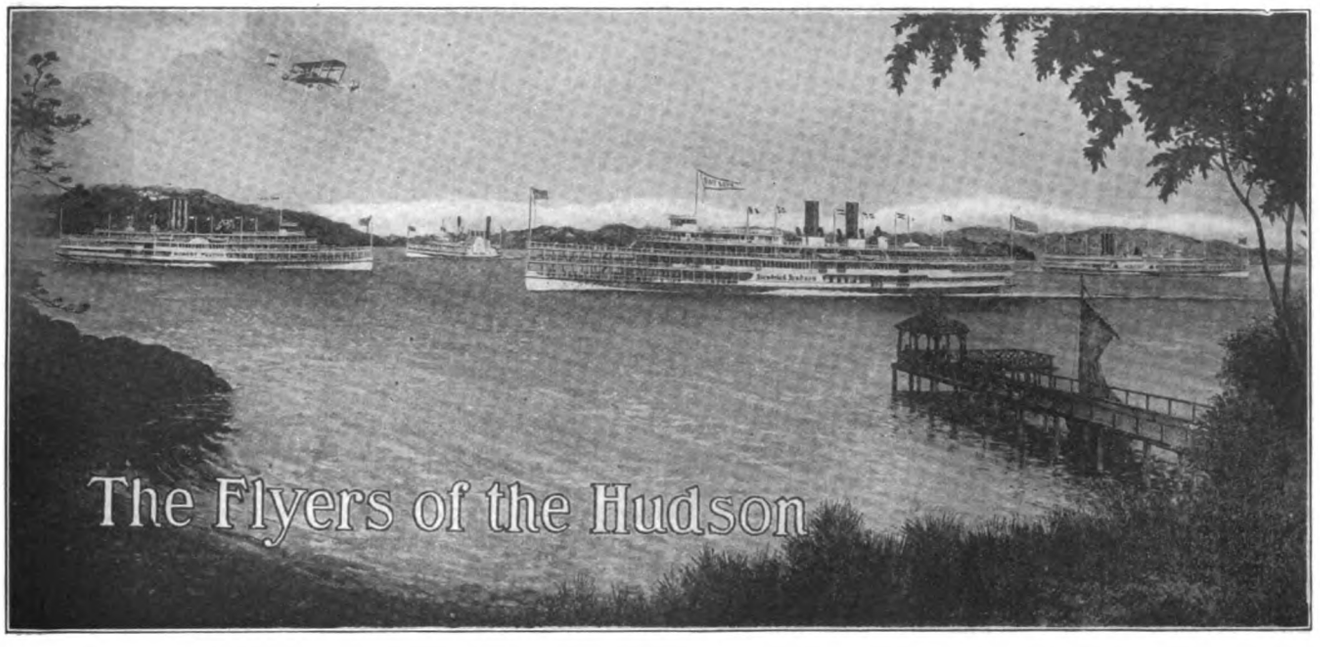

HUDSON RIVER DAY LINE

IT IS the purpose of THE MARINE REVIEW to present to its readers in succeeding issues brief descriptions of the leading passenger lines of the United States and Canada. The Hudson River Day Line has been selected as the initial of this series. Every country has its modes of transportation by water, but nowhere has passenger transportation been developed to such a degree of elegance and refinement as in the United States; and no country offers such a variety of scenery. It would be a liberal education to Americans if they would, from year to year, make trips upon the various lines.

The fleet of the Hudson River Day Line represents the highest development of the day steamer and the river upon which they ply is the most famed and best known of all American streams. It was discovered by Henry Hudson on Sept. 2, 1609, who entered the harbor on the evening of that day with a crew of Dutch and English sailors in the Half Moon. Hudson was an Englishman. His first name was Henry, but the Dutch sailors called him Hendrick and as Hendrick he is known to this day. Hudson explored the stream leisurely and wrote glowingly of its beauties. It is a matter of some doubt as to how far Hudson ascended the river, but, of course, he got well beyond the Catskills and probably ceased his exploration at some point above Stockport. There have been many changes since Hudson's day, but the natural beauty of the stream remains as it was. History has been made, however, along its banks. It furnished the background for many scenes in the revolutionary war. It was along its banks that Alexander Hamilton, the master mind, fell in his duel with Aaron Burr. It was near Tarrytown that Major Andre was captured and hanged as a spy. Washington Irving, the first and most beloved of American writers, has made the region famous with his fanciful tales of Rip Van Winkle and the Headless Horseman.

The fleet of the Hudson River Day Line consists of the steamers Mary Powell, Albany, Hendrick Hudson, Robert Fulton and Washington Irving. The

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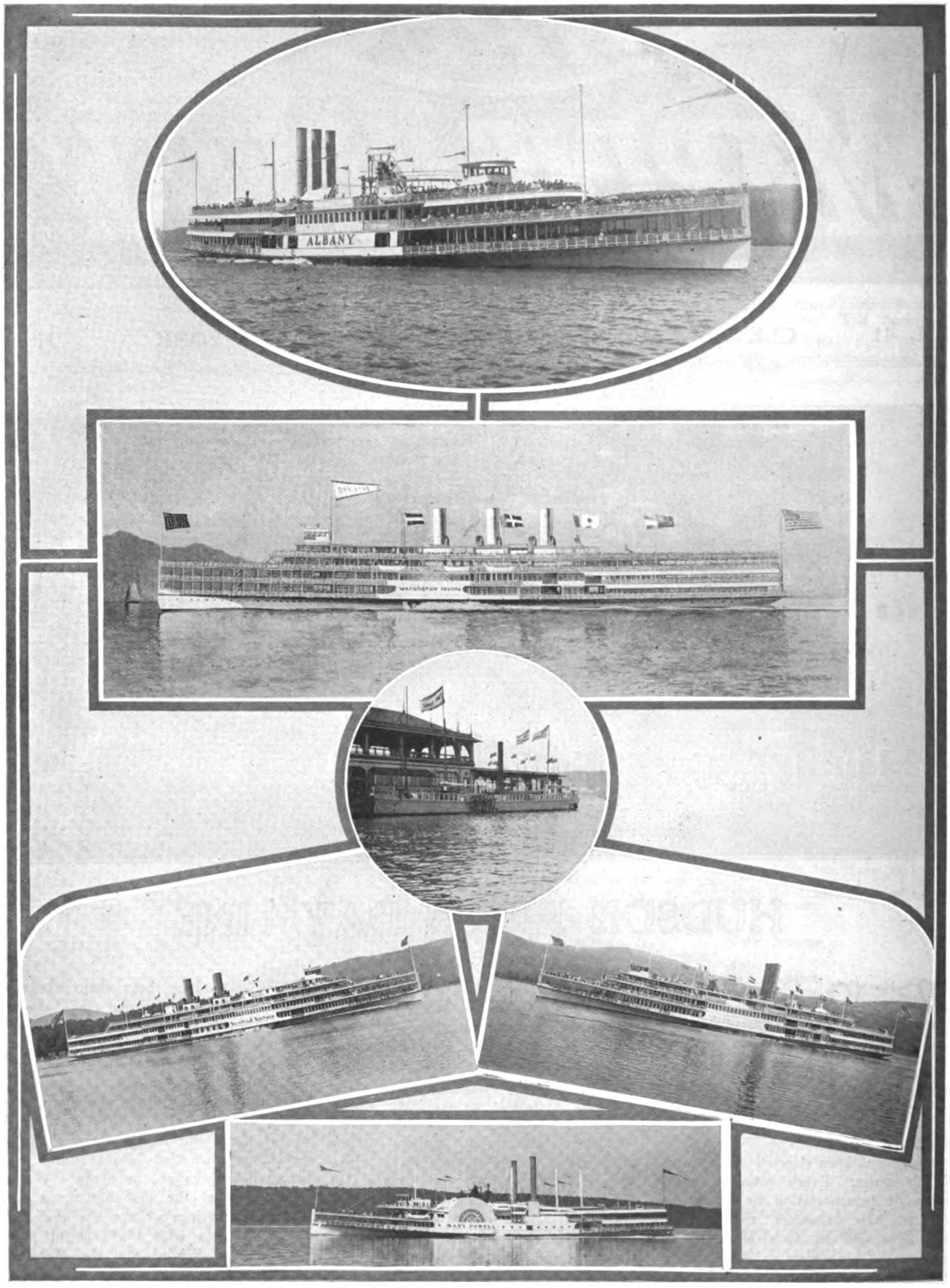

THE HUDSON RIVER DAY LINE'S FLEET OF STEAMERS. THE CIRCULAR PICTURE IN THE CENTER IS THE REPLICA OF THE CLERMONT.

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Irving, however, is still in process of construction and will not be in commission until next year. In addition, the company owns the replica of the Clermont, which was built for the centennial celebration of steam navigation on the Hudson river in the fall of 1909. It is especially fitting that the Hudson River Day Line should own this reproduction of the historic craft. Through officials whose fathers and grandfathers were connected with steam transportation on the Hudson since the days of Fulton, it is the logical successor of the Fulton-Livingstone Line of early days. Robert Fulton built the Clermont in 1807. She was 150 ft. long, 13 ft. beam and 7 ft. deep. Her draught was 2 ft. and under favorable conditions she could make four miles an hour. She was the first vessel to be successfully navigated by steam power, using sails occasionally as an auxiliary.

Her replica, now, as stated, in the possession of the company, was designed by Frank E. Kirby and J. W. Millard.

While larger and more elegant craft in outward show have been added to its fleet, none has displaced the Mary Powell in the affections of steamboat men. She came out in 1861 and immediately established herself as the queen of the Hudson. Both for speed and beauty she was unrivaled. In fact, her speed was always the wonder and delight of naval architects. This steamer is famed from one end of the continent to the other. Her symmetrical proportions are still retained, though there is probably no part of the original hull left in her. She was given a new hull in 1897 and refitted in 1910. The Mary Powell is 300 ft. over all, 288 ft. 9 in. on the waterline, 34 ft. 4 in. beam, 64 ft. over guards and 10 ft. 3 in. molded depth.

The Albany was built by the Harlan & Hollingsworth Co., Wilmington, Del., in 1880. During the winter of 1892 she was lengthened 30 ft. and fitted with modern feathering wheels in place of the old style radial ones. She is an iron steamboat, 325 ft. long and 75 ft. beam over all. Her engine was built by the W. & A. Fletcher Co., Hoboken, N. J., and on her trial trip she ran from New York to Poughkeepsie, a distance of 75 miles, in three hours and seven minutes. The carrying capacity of the Albany is 4,500, but a license for 2,500 passengers only is applied for in order that there may be no disagreeable crowding.

The Hendrick Hudson, designed by Frank E. Kirby and built by the Marvel Co., of Newburgh, N. Y., under contract with the W. & A. Fletcher Co., of Hoboken, N. J., who furnished her engines, came out in 1906. Her principal dimensions are: Length, 400 ft.; breadth over all, 82 ft.; depth of hold, 14 ft. 4 in., and draught, 7 ft. 6 in. Her propelling machinery consists of an inclined double-expansion paddle engine with three cranks, there being one high pressure cylinder, 45 in. in diameter, and two low pressure cylinders, each 70 in. in diameter, the stroke being 7 ft. Steam at 170 lbs. pressure is furnished by eight boilers, developing 5,000 h. p. at 41 r. p. m. The paddle wheels are of steel, each 24 ft. in diameter and each having nine curved steel buckets working in the so-called feathering style. She is of steel construction throughout and wherever possible the use of wood has been avoided altogether. On her trial trip she made 23.1 miles per hour. She is, of course, built exclusively for passenger service and carries no freight of any kind. Her four decks are entirely devoted to passengers. She has 14 large private parlors. The observation rooms on the upper deck are not only novel, but most attractive, as one can see from them, without moving from his chair, both sides of the river and ahead or astern and, being under the shade deck, have protection from the glare of the sun.

The steamer Robert Fulton came out in May, 1909. She was built by the New York Shipbuilding Co., Camden, N. J., in four and one-half months. The berths of this great yard are entirely under cover, so that the work progressed both day and night. Like the Hendrick Hudson, she is from designs by Frank E. Kirby, generally acknowledged to be America's foremost designer of this type of craft. The Fulton is 348 ft. long, 76 ft. beam over all, and 12 ft. 9 in. depth of hold. She has a beam engine built by the W. & A. Fletcher Co., Hoboken, N. J. She has all possible conveniences and is as nearly fireproof as it is possible to make this type of steamer.

Mr. Kirby is now designing a steamer to be known as the Washington Irving for the Line. It is the intention to put her into commission in the spring of next year and she will mark the 60th anniversary of the founding of the Line by the late Commodore Alfred Van Santvoord. It is the further intention to make her not only the largest, but the finest inland passenger vessel in the world. Her over all length will be 414 ft., her beam 86 ft., and with her five decks her carrying capacity will be 6,000 persons. Her decorative scheme, especially in so far as the mural part is concerned, will be based upon the writings of Washington Irving, embracing not only the story of Peter Stuyvesant's voyage up the Hudson, the domestic infelicities of Rip Van Winkle, incidents from Diedrich Knickerbocker's history of New York, but scenes from the Alhambra, that wonderful ruin which overlooks the ancient city of Granada.

The boats of the Hudson River Day Line are not exceeded by any river boats in the world. They carry no freight and are built exclusively for the business of carrying day passengers. They have neither sleeping accommodations nor bars.

The Toiler's Machinery

IN ITS July issue THE MARINE REVIEW published a brief description of the Toiler fitted with internal combustion engines of the Diesel type. Through the courtesy of *The Shipbuilder*, Newcastle-on-Tyne, it is now possible to give a more extended description of her machinery. The propelling machinery consists of two Diesel oil engines driving twin screws which develop 180 B. H. P. each at about 250 revolutions per minute. Their arrangement is indicated by sectional drawing, Fig. 1, and the photograph, Fig. 2. The weight of the engines is only about half that of steam engines and boilers of the same power, while the fuel consumption is only one-fourth the weight of that necessary if coal were being used in the ordinary way, so that there is a very considerable addition to the deadweight capacity available for cargo, amounting in this case to about 140 tons, compared to the steam-driven ship of similar dimensions. The Toiler is of Canadian canal dimensions, being 248 ft. long, 42 ft. 6 in. beam and 19 ft. molded depth. The cubical capacity available for cargo is also considerably increased both owing to the smallest space occupied by the engines and the fact that fuel can be carried in the double bottom when burning oil. The Diesel engines were supplied by the Aktiebolaget Diesel's Moterer, of Stockholm, and are of a type to which they have given the name Marine Polar Motor. One of the most noteworthy features of the design is the manner in which reversing is accomplished by means of compressed air. Fig. 3 shows the arrangement of the engine in diagrammatic form. The four two-cycle combustion cylinders marked 1 represent the working motor, the two double-acting cylinders marked 2 constituting what are termed the

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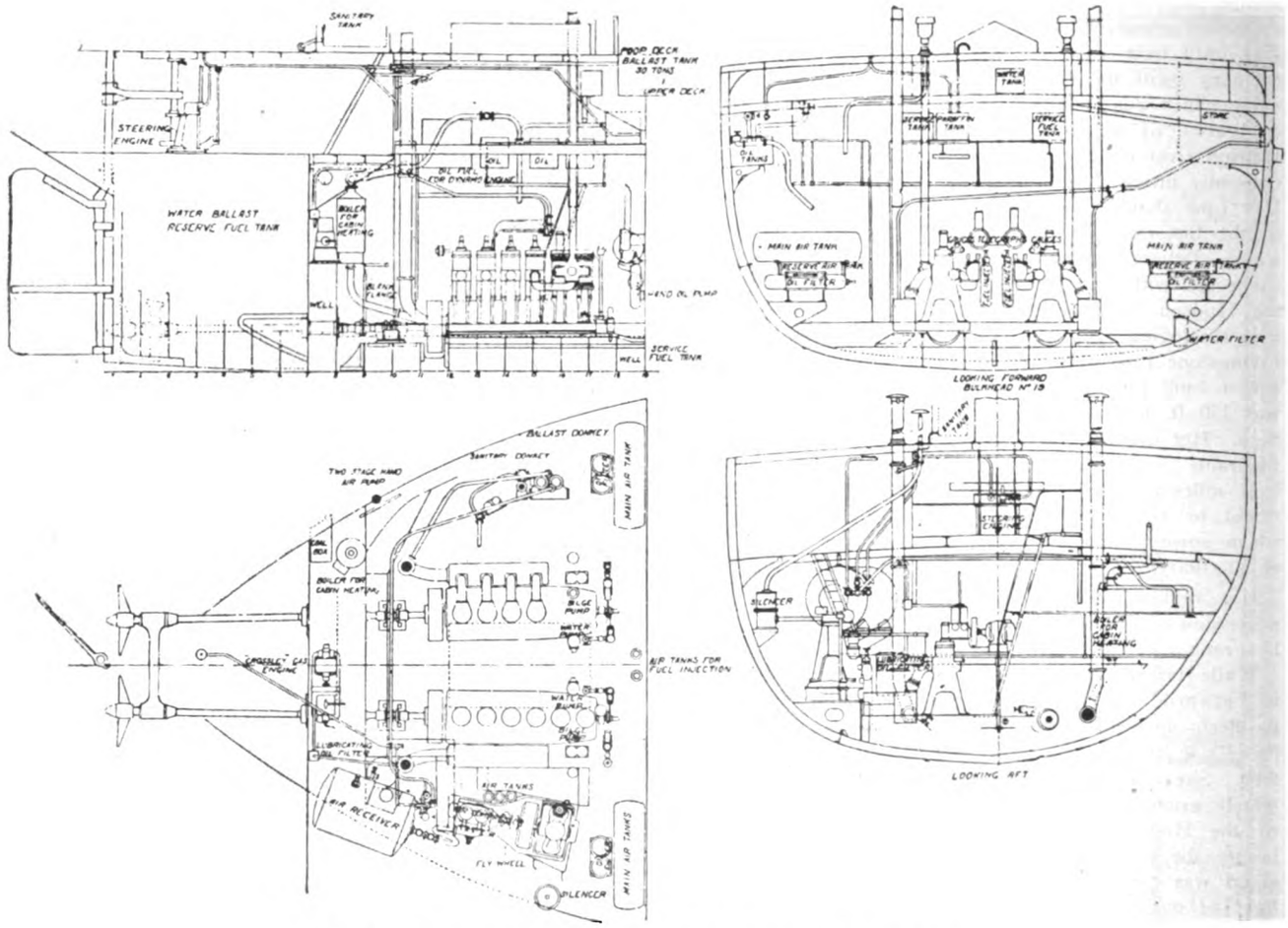

FIG. 1—ARRANGEMENT OF THE TOILER'S PROPELLING MACHINERY.

maneuvering motor. Under normal circumstances the maneuvering motor draws air from the atmosphere from the pipe 5 and delivers it slightly compressed through the channel 6 into the working cylinders 1. In the working cylinders this air is compressed to 36-38 atmospheres in order to assist the combustion and the development of power. The products of combustion are driven into the cylinder 17 and passes thence into the open air. When maneuvering the maneuvering motor is connected with a compressed air reservoir 9 instead of the atmosphere by turning the lever 18. The air used during maneuvering is automatically replenished by the air pump 8 which begins to act as soon as the pressure in the reservoir sinks below a certain amount. The liquid fuel is drawn from the tank 14 through the filter 15 by the fuel pump 16, and delivered to the fuel valves 13, being driven thence into the combustion chambers by means of the compressed air supplied from the air pump 11; 3 is the fly wheel and 4 the thrust block.

The construction and working of the maneuvering cylinders will be better understood from Figs. 4 and 5. The circle of Fig. 5 shows the order of events during one revolution of the engine, considering this cylinder to act firstly as an air pump under direct running and secondly as a

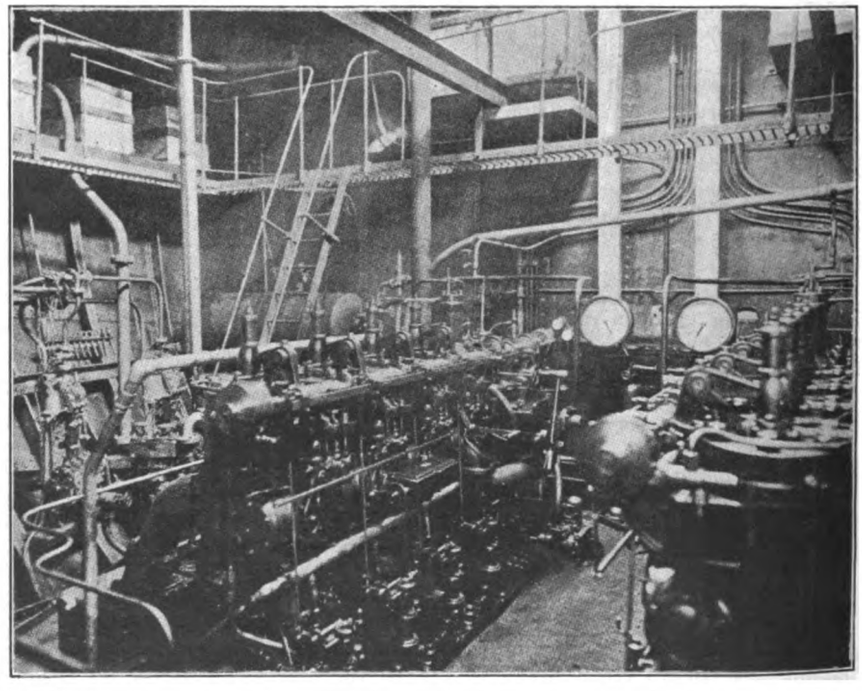

FIG. 2—THE ENGINE ROOM OF THE TOILER.

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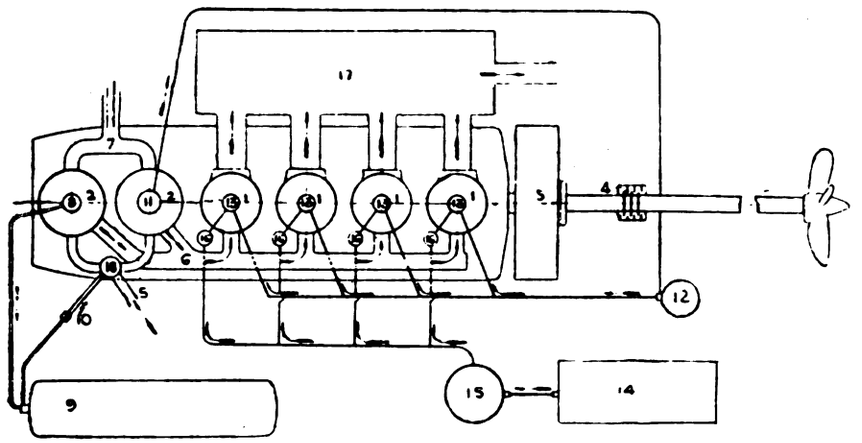

FIG. 3.

compressed air engine when maneuvering. Shortly after the piston has passed the upper dead center the slide valve opens at 1 and air is drawn into the cylinder until the valve closes at 2 (corresponding to the line A B on the imaginary indicator diagram). From 2 to 3 (B to C) there is a slight decrease in pressure which is neutralized at 3 when the piston passes an opening in the cylinder wall (35 in Fig. 4) thus placing the cylinder in communication with the outside air. After the piston passes the lower dead center this opening is closed again at 4 and compression ensues up to 5 (D to F), after which the compressed air is forced into the channel leading to the working cylinder. When maneuvering atmospheric air is cut off and compressed air admitted from 1 to 2, the indicator diagram becoming H I J D E D F G.

The action of the internal combustion cylinders is illustrated in Fig. 6. Air is supplied under pressure to the receiver 26 and passes thence

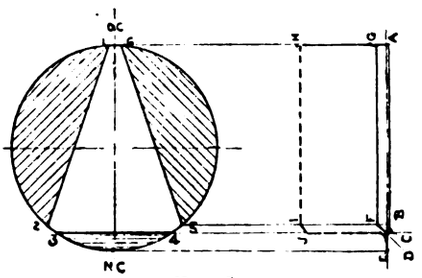

FIG. 5.

through the passage 41 which is laid open to the cylinder when the piston is at the bottom of the stroke. As the piston rises this passage is closed and the air is compressed until at about the top of the stroke a small supply of oil is admitted through the valve 25 and the resulting explosion provides the necessary source of power, the waste gases escaping through the opening 42 as the piston descends. The fuel valve 25 is controlled in the ordinary way by means of cams.

An ingenious method has been adopted for regulating the oil pumps and valves. Briefly the arrangement is such that during the period in which the motor revolves forward after the levers have been partly reversed the pumps supply no oil to the valves, thus avoiding contrary explosions. The maneuvering arrangements have proved very satisfactory in the Toiler and it is claimed that the engine can be changed from full speed ahead to full speed astern more quickly even than a steam engine. On one occasion she was submitted to an unusually severe test on returning to her builders' yard, when she was completely turned around and placed alongside a quay. In 16 minutes no less than 31 maneuvers were accomplished and the pressure never sank below eight atmospheres, the normal being 10 atmospheres.

The question of auxiliary machinery for the Toiler in view of the absence of steam required special consideration. The auxiliaries consist of a ballast donkey pump and a sanitary donkey pump in the engine room, and a capstan aft and a windlass forward on the deck, besides the steering gear. All these are driven by compressed air which is supplied by a separate compressor driven by a 30-H. P. Diesel engine. In addition there is a small electric light engine

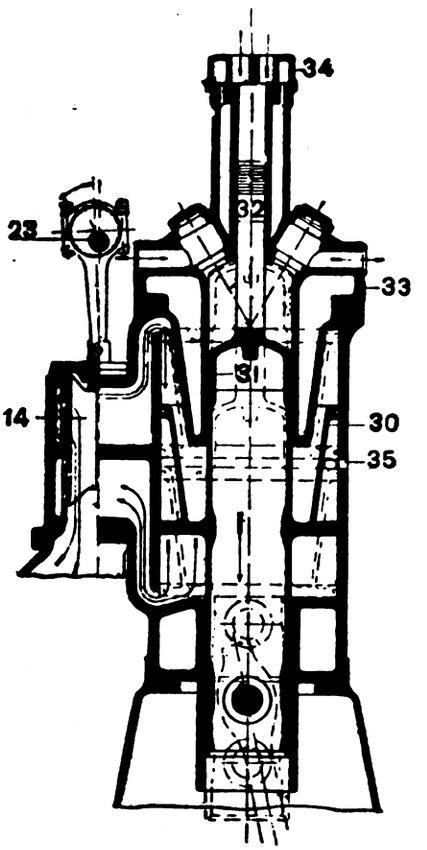

FIG. 4.

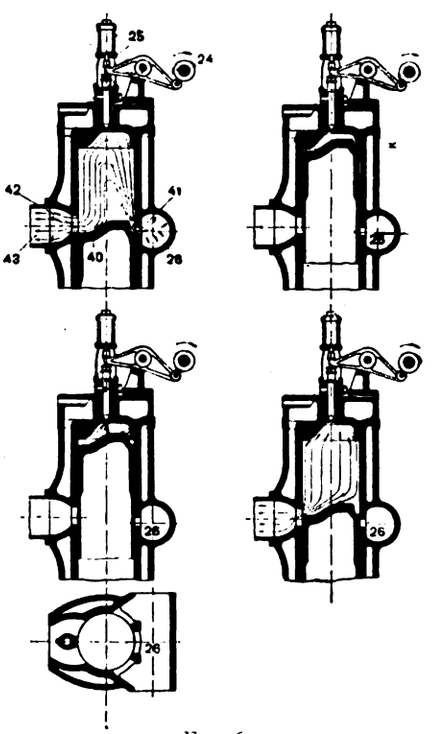

FIG. 6.

working on paraffine. The cabin heating is accomplished by a hot water system.

The San Francisco Bridge Co. has been awarded the contract by the United States government to dredge the San Pablo channel which leads to the Mare Island navy yard, to a depth of 30 ft. at low tide. This will be deep enough to accommodate the largest war vessels afloat. The estimated cost for the completion of the work is placed at $473,000, with 25 months the time limit.

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The Electric Arc

The Electric Arc is a small experimental vessel which has been built by MacLaren Bros., of Dumbarton, in connection with Mavor & Coulson, of Glasgow, to demonstrate the efficiency of electric speed reduction gear between a fast running engine and a slow running propeller. Her principal dimensions are: Length between perpendiculars, 50 ft.; beam, 12 ft.; depth, 7 ft. 4 in.; maximum draught, 4 ft. 6 in.

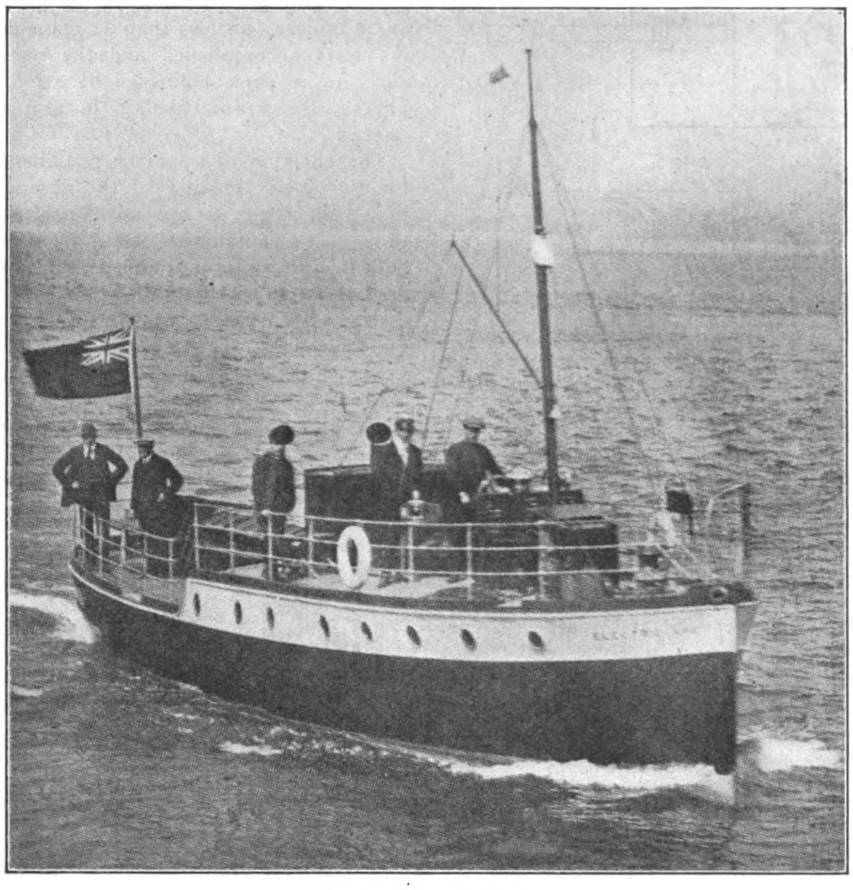

FIG. 1—ELECTRIC ARC.

Fig. 1 is a photograph of the Arc, and Fig. 2 is a plan of her general arrangement. The propelling machinery consists of a Wolseley six-cylinder petrol engine of 45 b. h. p., which drives an alternating current dynamo with its exciter from which current is supplied to a three-phase alternating current motor coupled directly to the propeller shaft. The continuous-current exciter is mounted on the top of the generator and is driven by belt from the main shaft. The stator of the generator is provided with two circuits of different periodicities and the rotor has windings which enable it to generate current in either or both windings of the stator. The motor, driving the propeller shaft, has also two independent windings giving different numbers of poles. The combination of motor and generator windings for different speeds of ship is shown diagrammatically in Fig. 3. The first combination of generator and motor windings gives the full speed of 7.25 knots or 8.3 miles per hour, and the second combination about two-thirds of full speed, about five knots. The arrangement is equivalent and corresponds in operation to the case where there are two separate engines, both being used at full speed and only one at low speed. The control of the motor is accomplished by means of two simple switches. One of these switches controls the excitation of the generator magnet and by its means the supply of current from the generator to the motor is controlled in a moment from nothing to the full supply. The second switch is interlocked with the first, so that it can only be operated when the current is shut off. It controls the direction of the supply to the motor in one or both of the motor windings so as to give slow speed or full speed ahead or astern. These switches are operated directly by chain connection from the ship's telegraph on deck so that the navigator in operating the telegraph actually performs the switching operations and brings about the desired result. It is claimed for the transmission gear that it provides a simple, trustworthy and economical means of adapting the power generator to the screw, thus permitting each to run at the most economical speed; that it provides means of changing the speed ratio between the generator and propeller so that the power of the generator may be developed under the most favorable conditions at all the speeds of the ship; that it provides a ready means of reversing the direction of rotation of the propeller without changing the direction of rotation of the power generator; and that it allows the power of one or more engines to be applied to one or more propellers, so that the power generating units may be so disposed that they give the highest efficiency, and that when one or more of them are not required, they can be stopped.

A series of trials were carried out early in June consisting of a double

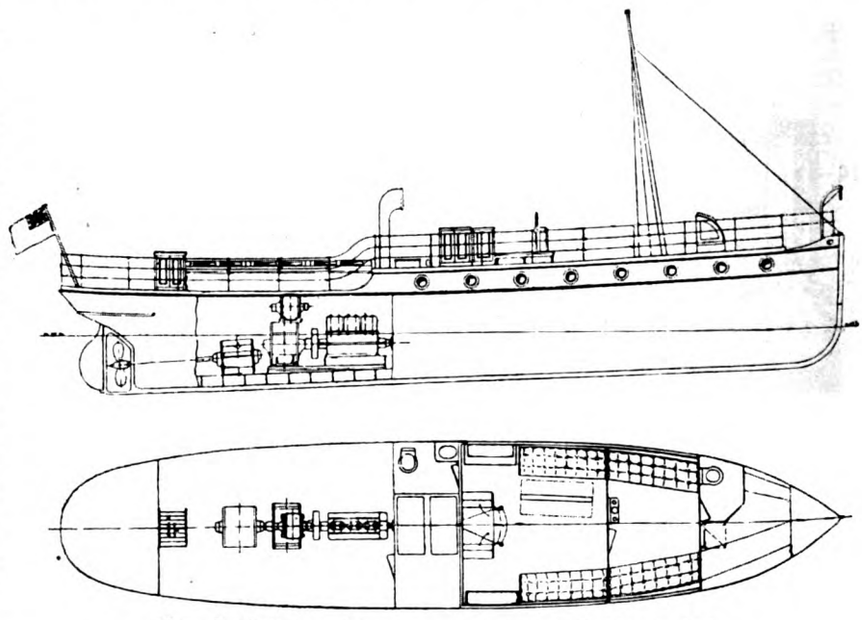

FIG. 2—GENERAL ARRANGEMENT OF THE ELECTRIC ARC.

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run over the measured mile on the Gareloch and a number of tests for determining the stopping, starting, speed changing, reversing and maneuvering powers of the vessel. The mean speed attained on the double run was 7¼ knots with the propeller running at 415 revolutions per minute and the engine at 800 r. p. m. The vessel was stopped from full speed ahead in 23 seconds

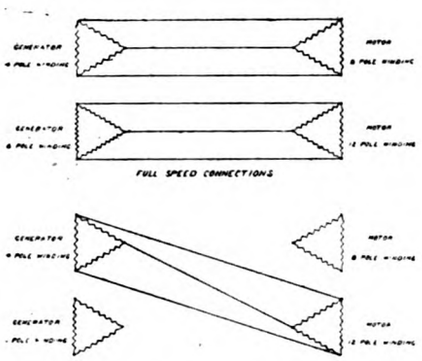


FIG. 3—DIAGRAM OF CIRCUITS IN THE "ELECTRIC ARC."

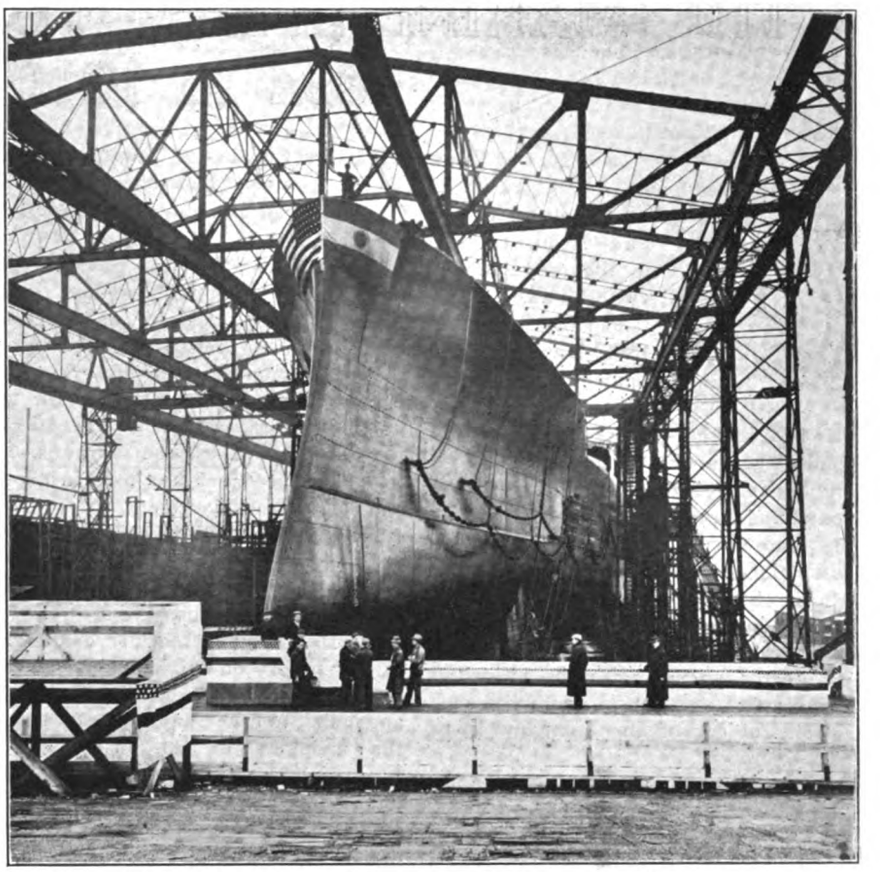
and the propeller was reversed from full revolutions ahead to two-thirds revolutions astern in 13 seconds. It was also shown that it was possible to throw the switch instantly right over from full ahead to full astern without any risk of damage to the machinery. Doubtless more will be heard of the Electric Arc in the near future.

Battleship Rivadavia Launched

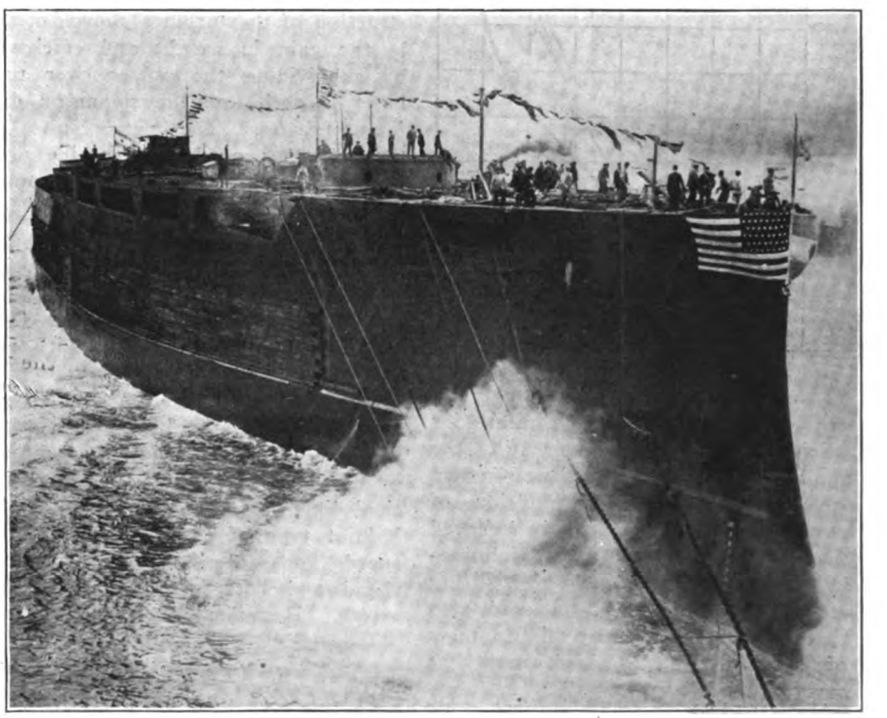
The Fore River Ship Building Co., Quincy, Mass., launched on Aug. 26 the battleship Rivadavia for the Argentine Republic. The Argentine government appointed Senora Rosa Saenz Pena, wife of the president of the Argentine Republic, as the official sponsor, and as her proxy in this country the actual christening was performed by Senora de Naon, wife of the Argentine minister to this country, Dr. Romulo S. De Naon. The Rivadavia was described in the August issue of THE MARINE REVIEW.

World's Wastage of Vessels

The annual summary of the vessels of all nations totally lost during the year 1910, has just been issued by Lloyds Register of Shipping. It shows that 562 vessels of 591,536 gross tons passed out of existence. Of this number 293 of 421,549 gross tons were steamers and 269 of 169,987 tons were sailing vessels. The United Kingdom heads the list of losses with 129 vessels of 222,069 tons. The United States comes next with 75 vessels of 50,996 tons, exclusive of those lost on the great lakes. Norway lost 73 vessels of 67,971 tons; Germany lost 39 of 44,233 tons, and France lost 31 of 20,789 tons. Russia lost 31 vessels of 19,441 tons, and Spain 15 vessels of 17,599 tons. Of the losses 42 were abandoned at sea, 28 were condemned and broken up, 31 were burned, 71 were lost in collisions, 56 foundered and 41 are missing.



BATTLESHIP RIVADAVIA, TAKEN JUST PRIOR TO HER LAUNCHING.



BATTLESHIP RIVADAVIA IMMEDIATELY AFTER SHE LEFT THE WAYS.

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THE MARINE STEAM TURBINE FROM 1894 to 1910*

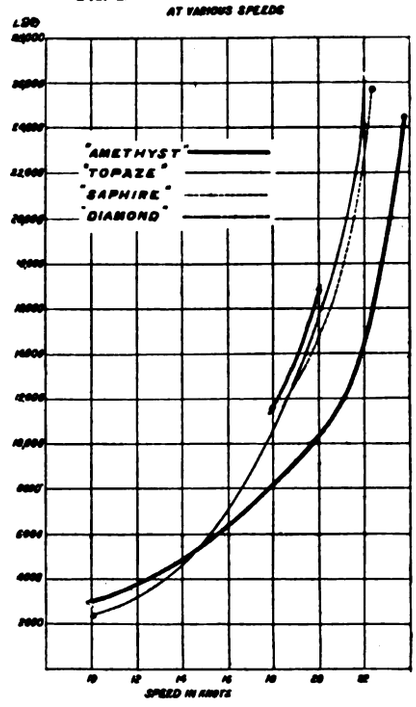
By the Hon. Sir Charles A. Parsons, Vice President.

THE application of the steam turbine to the propulsion of vessels was entertained as early as 1884, but its development was not seriously considered till 1892, when the economy of the condensing turbine as applied to driving dynamos had excelled that of the compound reciprocating engine for the same purpose.

A pioneer association, called the Marine Steam-Turbine Co., Ltd., was formed in 1891, whose object was the investigation of the subject. The prospectus opened with the following paragraph:

"The object of the company is to provide the necessary capital for efficiently and thoroughly testing the application of Mr. Parsons' well-known steam-turbine to the propulsion of vessels. If successful, it is believed that the new system will revolutionize the present method of utilizing steam as a motive power, and also that it will enable much higher rates of speed to be attained than has hitherto been possible with the fastest vessels."

Fig. 1. COAL CONSUMPTION PER HOUR AT VARIOUS SPEEDS



From the first it was obvious that the turbine was suitable to fast rather than to slow vessels, and, consequently it was decided to commence by building an experimental vessel of the smallest size consistent with the possibility of attaining exceptional speed. This vessel, the Turbinia, 100 ft. in length, 9 ft. beam, 6 ft. in depth, and 42 tons displacement, after many alterations to her machinery, developed 2,400 horsepower on trials, and attained a maximum speed of 34½ knots. The machinery and trials of the little vessel were fully dealt with in the report of Professor J. A. Ewing, F. R. S., to be found in the appendix to the paper read before the members of the institution in June of 1903.† The trials of the Turbinia threw some additional light on the phenomenon of cavitation previously observed by Sir John Thornycroft and Sydney Barnaby, and demonstrated the necessity for very wide blades and a sufficiency of total area in the propellers of such vessels. It was also shown that propellers of relatively small diameter and high revolutions could be designed to approach very closely in efficiency to propellers of large diameter and normal revolutions. Further, the reconstruction of the turbines showed clearly the gain in weight and efficiency by subdividing the power over turbines in series on the steam on different shafts. The net results of these trials proved that turbine propelling machinery was more economical than reciprocating machinery for high-speed vessels.

At this stage the pioneer association was transferred to a new company, the Parsons Marine Steam-Turbine Co., Ltd., for dealing with the system on commercial lines. The first order was in 1899 for a destroyer, the Viper, from the British admiralty, Sir William White being then director of naval construction. The principal dimensions were the same as the 30-knot type of that period, but the speeds guaranteed were 31 knots ahead and half full-speed revolution astern. Her maximum speed during a one hour's special trial, but with approximately full weights on board, was 36.5 knots, and under contract conditions of coal consumption was 33.38 knots. The economy in coal consumption at high speeds was good and she fulfilled in every respect the contract conditions, but the results of cruising speeds showed the desirability of modifications in the turbines in future designs to improve the economy at cruising speeds, and in all subsequent war vessels cruising turbines or cruising elements have been added at the high-pressure end of the turbine installation. In some very recent vessels impulse elements, in others geared high-pressure turbines, are being employed for the same purpose. At about the same time as the Viper was ordered, Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., placed an order for the machinery of another destroyer, the Cobra. The machinery of the Cobra was a duplicate of that fitted in the Viper. The Cobra on a three hours continuous run maintained the mean speed of 34.6 knots.

Fig. 2.

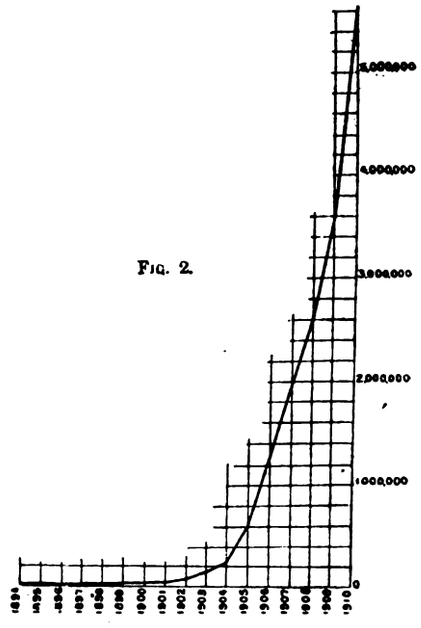


Fig. 2—Diagram Showing Total Horsepower of Parsons' Steam Turbines Applied to Marine Propulsion, Completed and Under Construction Each Year From 1894 to December, 1910.

It was very early realized that the

*Paper read at the Jubilee meetings of the Institution of Naval Architects, July 5, 1911.

†"The Steam-Turbine and Its Application to the Propulsion of Vessels," by the Hon. C. A. Parsons. Read before the Institution of Naval Architects, June, 1903.

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suitability of the turbine for steam of very low pressure, which had been proved by the high percentage of power realized in the low pressure portion of land turbines, would find an important application in ships by working the turbine from the exhaust of reciprocating engines, but not until 1901 was the first combination vessel, the Velox, 3 30-knot destroyer, laid down as a speculation

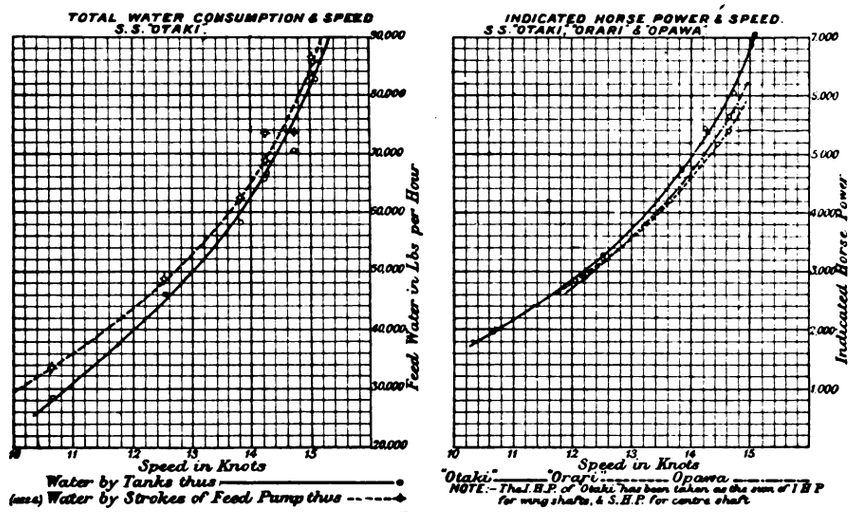
TOTAL WATER CONSUMPTION & SPEED
S.S. 'OTAKI'.
Feed Water in Lbs per Hour
Speed in Knots
Water by Tanks thus
Water by Strokes of Feed Pump thus
INDICATED HORSE POWER & SPEED.
S.S. 'OTAKI,' 'ORARI' & 'OPAWA'
Indicated Horse Power
Speed in Knots
'Otaki.' 'Orari' Opawa
NOTE:- The I.H.P. of 'Otaki' has been taken as the sum of I.H.P for wing shafts, & S.H.P. for centre shaft.

FIG. 3.

by the Parsons Marine Steam-Turbine Co., Ltd. Her main propelling machinery was nearly a duplicate of the Viper's, but in order to increase the economy at speeds below 13 knots, two triple-expansion engines of 150 horsepower each were coupled to the low-pressure turbine shafts through flexible and detachable clutch-couplings. At low speeds the reciprocators exhausted into the high-pressure turbines; at speeds above 13 knots the engines were uncoupled. The vessel was acquired by the admiralty in 1903. The same year H. M. S. Eden, of practically the same dimensions as the Velox, was launched, and cruising turbines in series were fitted in her instead of reciprocating engines.

The admiralty carried out a series of comparative trials at cruising speeds with the Eden and Velox, and a sister vessel with reciprocating engines, of which the table below is a summary.

Water Consumption Per Hour at Various Cruising Speeds.

	Lb. per hour.
At 11 knots:—	
Velox, using piston engines exhausting into ordinary turbines	8,650
Eden, using cruising turbines exhausting into ordinary turbines	16,146
Piston-engined destroyer	14,892
At 13 knots:—	
Velox, using high-speed turbines only	24,375
Eden, using cruising turbines exhausting into ordinary turbines	21,230
Piston-engined destroyer	18,140
At 15 knots:—	
Velox, using high-speed turbines only	32,750
Eden, using low-pressure cruising turbines exhausting into ordinary turbines	28,000
Piston-engined destroyer	28,750
At 18 knots:—	
Eden, using low-pressure cruising turbine exhausting into high-speed turbines	41,050
Piston-engined destroyer	45,645

In 1902 the admiralty placed the order for the third-class cruiser Amethyst with turbines, and for three sister vessels with reciprocating engines of 10,000 horsepower. The turbine installation of the Amethyst was of the usual three-shaft arrangement, the high-pressure turbine driving the center propeller, and the two low-pressure turbines in parallel on the steam driving the wing propellers, a high-pressure cruising turbine and an intermediate-pressure cruising turbine being also directly coupled through flexible claw couplings to the low-pressure turbine shafts; these latter were in series on the steam with the main high-pressure turbine. The trials of these vessels conclusively proved the superiority of the turbine in water consumption (Fig. 1). At speeds of 15 knots, the water consumption of the turbine vessel was equal to that of the reciprocating vessels, and at higher speeds the superiority of the turbine was considerable, while at the designed speeds of 21¼ knots it reached 30 per cent, and at the maximum coal consumption allowed by the specification, the power developed, as estimated from the curve of resistance of the vessel, by the turbine vessel exceeded the power developed by the reciprocating vessel by 42 per cent. The maximum speed attained by the Amethyst was 23.6 knots as against 22.3 knots for her sister ship. The increased efficiency derived from the cruising turbines was very marked at low speeds, at some speeds 20 per cent of the total power being developed by them.

Subsequent to the official trials arrangements were made for utilizing the auxiliary exhaust in the turbines, when a further increase in economy was obtained.

The comparative trials of these vessels had a great influence upon the future of the turbine.

As a general rule, the larger and faster the vessel, the more easy it had been to arrive at a satisfactory and profitable all-turbine solution as regards efficiency and first cost. Below the sea speed of 16 knots, the solution is not altogether favorable, and very few such vessels have been fitted. A slight lowering of the boundary of suitable speed exists in very large vessels, and also may be effected by the employment of the impulse principle at the high-pressure end, as more fully explained later.

This most important question of applying the turbine to lower-speed vessels has from the commenceemnt received consideration, and one satisfactory solution appeared to lie in the combination system to which we shall further allude later. Another solution with a somewhat different scope has more recently been investigated; it is the use of double helical gearing of the De Laval class on a large scale for gearing the high-pressure portion only, or in some cases the whole of the turbines on the screw shafting. Both of these solutions have given satisfactory results, but the reduction gearing appears to be the more important as applicable to vessels of all speeds. Both systems are described more fully later.

The first turbine battleship, Dreadnought, was laid down at Portsmouth, in October, 1905. The primary contract for the whole of the machinery was placed with Vickers Sons & Maxim, Ltd., the Parsons Marine Steam Turbine Co., Ltd., being subcontractors for the turbines. She has four shafts, two high-pressure and two low pressure turbines, and two cruising turbines are coupled to the low-pressure turbine shafts. The astern turbines consist of a high-pressure

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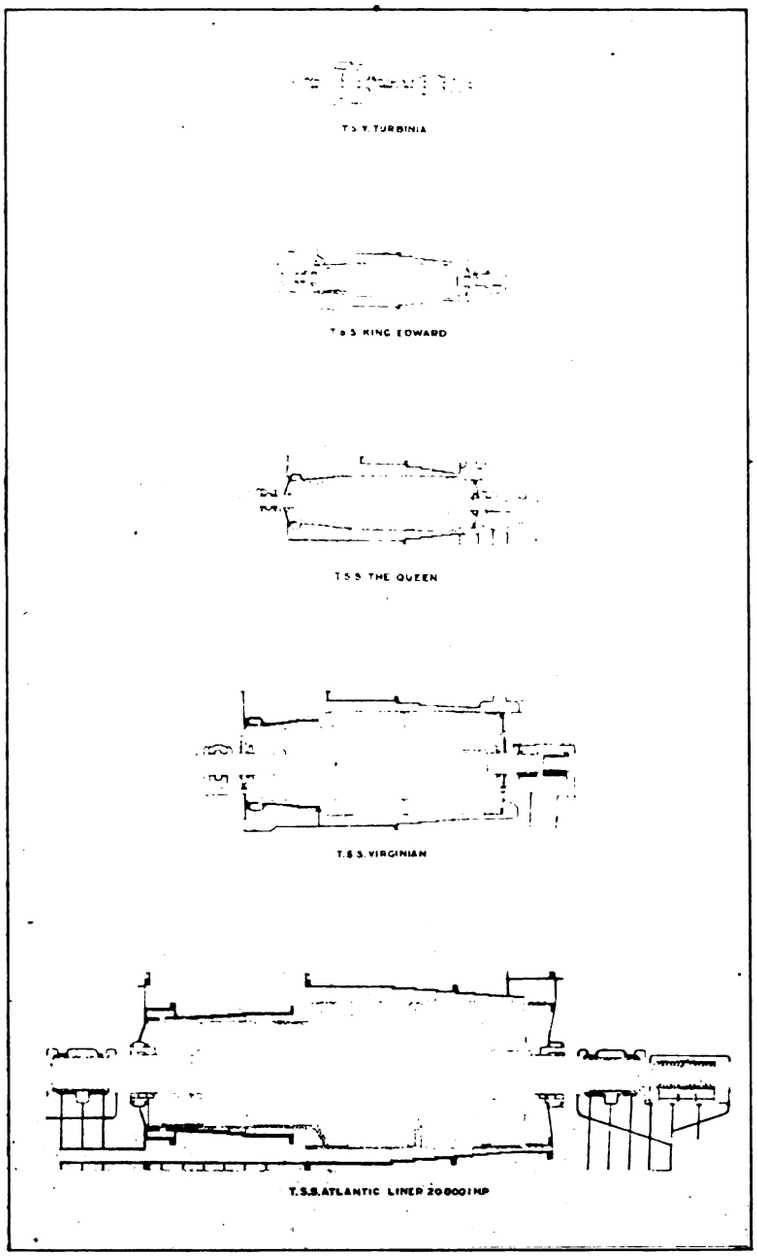

FIG. 4.

astern portion in a separate casing on the high-pressure ahead shaft, in series with a low-pressure astern portion incorporated in the main low-pressure turbine casing. The cruising turbines are in parallel, and not in series, on the steam as in the Amethyst; the high-pressure, low-pressure, cruising and astern turbines comprise one propelling unit on each side of the vessel.

We may quote a summary of the advantages of the system, the reasons given by the First Lord of the British admiralty for the adoption of the Parsons turbine in the Dreadnought and succeeding ships as determined by a committee on naval design:—"The question of the best type of propeling machinery to be fitted was most thoroughly considered. While recognizing that the steam turbine system of propulsion has, at present, some disadvantages, yet it was determined to adopt it because of the saving in weight and reduction in number of working parts, and reduced liability to breakdown, its smooth working, ease of manipulation, saving in coal consumption at high powers, and hence boiler-room space, and saving in engine-room complement; and also because of the increased protection provided for with this system, due to engines being lower in the ship—advantages which more than counterbalance the disadvantages. There was no difficulty in arriving at a decision to adopt turbine propulsion from the point of view of sea-going speed only. The point that chiefly occupied the committee was the question of providing sufficient stopping and turning power for purposes of quick and easy maneuvering. Trials were carried out between the sister vessels Eden and Waveney, and the Amethyst and Sapphire, one of each class fitted with reciprocating and the other with turbine engines; experiments were also carried out at the admiralty experimental works at Haslar, and it was considered that all requirements promise to be fully met by the adoption of suitable turbine machinery, and that the maneuvering capabilities of the ship when in company of a fleet, or when working in narrow waters, will be quite satisfactory.

Sir Henry Oram, the engineer-in-chief of the fleet, in his address as president of the Junior Institution of Engineers, stated that at full power the steam consumption of the Dreadnought was 13.48 lb. per shaft horsepower per hour, while in the succeeding battleships of the class it averaged 13.01 lb., and in the three cruisers of the Invincible class 12.03 lb. With reciprocating engines nearly 16 lb. would be a fair average, and it thus follows that a great reduction in boiler weights was permissible. Again the high efficiency of the low-pressure turbine made it well worth while to pass the exhaust steam from the auxiliary engines to this turbine instead of to the condenser. Indeed, the exhaust steam in some battleships has been proved to be alone sufficient to drive the vessel at a speed of 5 to 6 knots.

The coal consumption at full power of the three 26-knot armored cruisers of the Invincible class ranged from 1.2 lb. to 1.7 lb. per shaft horsepower per hour, the average of the three ships being 1.47 lb. per shaft horsepower. In the three cruisers of the Minotaur class, with piston engines, it was 1.8 lb., and in the six cruisers of the Duke of Edinburgh or Warrior class, 2.1 lb. per indicated horsepower per hour. On the 30 hours' endurance trial at 70 per cent of the total power, the turbines also proved more efficient, although the advantage was not so marked. At one-fifth power the coal consumption of the three Invincible cruisers averaged 2.4 lbs. per shaft horsepower per hour, as compared with 1.87 lb. per indicated horsepower per hour in the Minotaurs and 2.05 lb. in the Duke of Edinburgh cruisers.

In the mercantile marine the first vessel to be fitted with turbines was the Clyde passenger steamer, King Edward, built to the joint ownership

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of Captain John Williamson, Messrs. Denny, of Dumbarton, and of the Parsons Marine Steam-Turbine Co., Ltd. Her length is 250 ft., and, with 3,500 horsepower, she attained a speed of 20.48 knots. Her success led to the construction of a second vessel for the Clyde passenger traffic in 1903, and in the same year the Queen was built for the Dover and Calais route. All these vessels have three shafts, the high pressure turbine in the center exhausting into two low-pressure turbines on the wing shafts. Thus, by 1904, two of the most suitable fields for the marine turbine had been entered, namely, for vessels of war and cross-channel and passenger service, and, by 1905, the turbine was being adopted for nearly all new cross-channel steamers of high speed built in this country, and about a year later by the British admiralty for all new construction.

The application to large liners remained as yet untouched. The first vessels to be fitted for trans-Atlantic service were ordered by the Allan line, viz., the Victorian and Virginian. This marked a notable step in advance in the application of the new system to ocean-going ships of high speed. At this juncture the late Lord Inverclyde appointed a commission of experts to investigate the suitability of the turbine for two express Cunarders for the New York route. After most careful consideration of all data then available and in view of much additional experimental research conducted by the committee, as well as tests on large land turbines, and on existing turbine vessels, the committee unanimously recommended turbines in preference to reciprocating engines for the Mauretania and Lusitania of 70,000 horsepower and 24½ knots sea speed. The performance of these vessels has justified the decision; a mean speed of 26 knots has been maintained in favorable weather across the Atlantic, and an average speed of 25½ knots has been maintained on many successive voyages. This step completed the entry of the turbine into all classes of fast vessels for which it was at the time deemed suitable, and its adoption for fast vessels has been almost universal.

In 1904 the general policy of granting licenses on easy terms was decided upon by the Parsons Marine Steam-Turbine Co., and by the end of 1905 a large number of shipbuilding and engineering firms had acquired marine licenses, the number having considerably increased up to the end of 1910. It is now clear that the broad policy then adopted has been conducive to the exceptionally rapid adoption of the turbine. Turbines of the Parsons type are now being built in the principal engineering works of France, Germany, Austria, Italy, Russia, Spain, Belgium, Sweden and Denmark, as well as in Japan and the United States of America. The curve of horsepower (Fig. 2) completed and on order each year up to the end of 1910 shows the development which has taken place since the introduction.

Since the construction of the turbines of the Turbinia in 1897, which were in series on the steam and on three shafts, there has been no very notable increase in economy in steam per shaft horsepower, excepting that due to size and consequent reduction of leakage and steam friction losses, the reason being that the turbines of the Turbinia were designed with as high a velocity ratio as has been found compatible with weight and space, and that her condensers were of ample size.

In marine turbine design the chief governing factors are weight and cost dependent on a limited surface speed of turbine, which is governed by the maximum speed of revolution allowed by the propeller, and from the commencement a judicious compromise has been arrived at between turbine and propeller. Such limitations will, however, be materially reduced, should geared turbines come into use, and higher co-efficients of turbine efficiency would then become possible and compatible with moderate first cost and weight; the question of propeller efficiency would be more easily dealt with, and the gain in total propulsive efficiency thereby would be substantial.

Types of Turbine.

There are four principal types of turbine now in use for marine work:

1. The compound class, introduced in 1894 in the Turbinia, in which there are a very large number of turbines on drums in series, with small pressure-drops at each turbine and low steam velocities. Generally the guide-vanes are identical with the moving vanes, each taking half the pressure-drop, but occasionally the moving vanes are formed like cups or buckets, and then the whole pressure-drop is taken on the guides. This class comprises say, 90 per cent of all marine turbines at the present time.

2. The multiple impulse compounded or Curtis type introduced in the Revolution and in the Creole in 1904 and the Salem in 1906. This system differs radically from the compound class, in that there are comparatively few stages, large pressure-drops take place at the guides or nozzles, and the high steam velocities generated are absorbed in a sinuous course between several rows of moving and fixed buckets.

3. A combination of the two types (1) and (2), in which the earlier part of the expansion is taken by the impulse type and the low-pressure part by the compound type. The impulse Parsons, with one impulse-wheel, the Brown-Curtis with several impulse-wheels, the A. E. G. turbines and others are instances of this type.

4. The multiple or compound De Laval wheel type, in which there are a large number of simple bucket wheels working in separate chambers. The pressure drops are moderate, and take place wholly in the guides, which form the passageway from chamber to chamber. The Rateau, the Zoelly, the Bergman, and others are instances.

After type (1), type (3) has received the largest use in marine work, more especially in Germany. Each class or type has its advantages and disadvantages, but within the scope of the paper it is not possible to do more than make a few general remarks.

The compound class has low steam velocities, and there is no cutting action of the blades by the steam. Its efficiency, when the blades are of reasonable length, and leakage consequently small, is the highest, as the skin friction losses in the blades and of the moving drums and dummy pistons are small. On the other hand, when the design necessitates very short blades, as may occur at the high-pressure end, then the efficiency is reduced by leakage.

The multiple impulse type has a lower efficiency because of the skin friction losses of the steam circling through the blades at high velocity, and from the spilling of the steam from the buckets. On the other hand, it is less subject to leakage than the compound, and in the case of the first wheel of a series there is no leakage at all, and the only losses are skin friction and spilling. One impulse wheel, therefore, is a good substitute in certain cases for the initial stage of the compound, and in this design no diaphragms or shaft packings are required. The advantage of replacing several initial stages of the compound by several multiple impulse wheels in chambers separated by diaphragms and shaft packings, is somewhat questionable, and on it a difference of opinion exists.

Class (4) has small leakage losses, but involves relatively more skin friction loss from the large surface of the many discs revolving in the steam,

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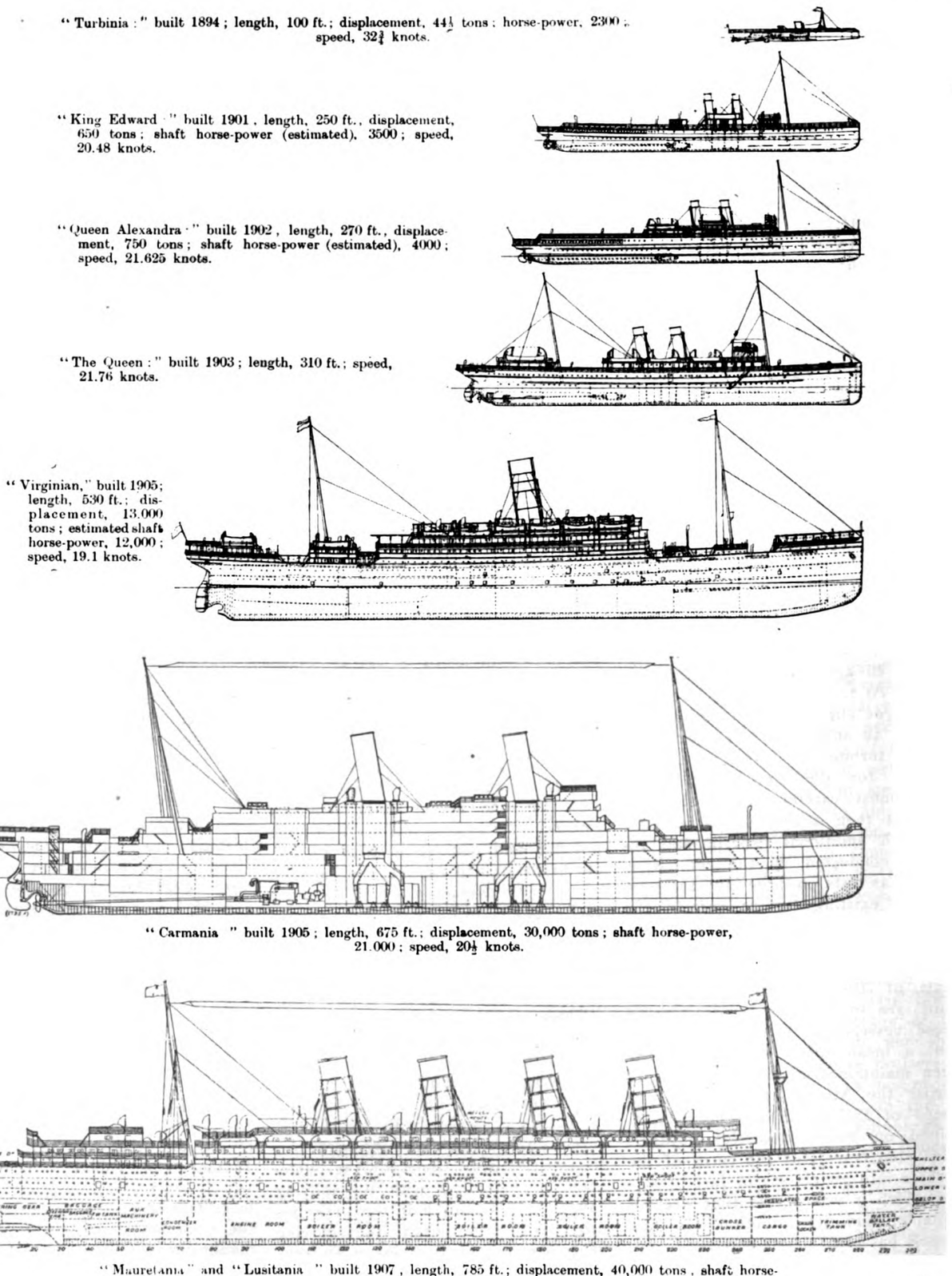
"Turbinia:" built 1894; length, 100 ft.; displacement, 44½ tons; horse-power, 2300; speed, 32¾ knots.
"King Edward" built 1901, length, 250 ft., displacement, 650 tons; shaft horse-power (estimated), 3500; speed, 20.48 knots.
"Queen Alexandra" built 1902, length, 270 ft., displacement, 750 tons; shaft horse-power (estimated), 4000; speed, 21.625 knots.
"The Queen:" built 1903; length, 310 ft.; speed, 21.76 knots.
"Virginian," built 1905; length, 530 ft.; displacement, 13,000 tons; estimated shaft horse-power, 12,000; speed, 19.1 knots.
"Carmania" built 1905; length, 675 ft.; displacement, 30,000 tons; shaft horse-power, 21,000; speed, 20½ knots.
"Mauretania" and "Lusitania" built 1907, length, 785 ft.; displacement, 40,000 tons, shaft horse-power, 74,000; speed, 26 knots.

FIG. 5—DIAGRAM SHOWING GROWTH IN SIZE OF TURBINE-PROPELLED MERCHANT SHIPS

which in the initial chambers is of high density.

The Combination System.*

The Velox, in 1901, as has been stated, was the first combination vessel. The system was described and advocated by me in my presidential address of the Institute of Marine Engineers, in January, 1905. The Otaki, of 464 ft. length, 9,900 tons dead weight capacity, built and engined by Messrs. Denny, of Dumbarton, in 1908, for the New Zealand Shipping Co., was the second; the sister vessels, the Orari and Opawa, were fitted with triple-expansion engines. The diagram (Fig. 3), which is taken from a paper by Engineer-Commander W. McK. Wisnom, R. N., before the Institution of Engineers and Ship Builders in Scotland, vol. lii, page 279, gives the comparative results.

*"The Combination System of Reciprocating Engines and Steam Turbines," by the Hon. C. A. Parsons and R. J. Walker, before the Institution of Naval Architects, April 9, 1903.

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About the same time the Laurentic and Megantic were laid down by Messrs. Harland and Wolff, for the Canadian service. They were 565 ft. in length, and about 20,000 tons displacement. The first was fitted with triple expansion engines driving the side screws, and a low-pressure turbine driving the center screw. The latter vessel was fitted with the usual quadruple expansion engines and twin screws. In service it is stated that the combination vessel consumes 12 to 14 per cent less coal than the sister vessel.

In 1909, Messrs. Harland & Wolff commenced the Olympic and Titanic, of 882 ft. 9 in. in length, and about 60,000 tons displacement, the arrangement of combination machinery being similar to that of the Laurentic, with a collective horsepower of 30,000, the designed sea speed is 21 knots. The same firm is fitting the combination system in the Demosthenes, of 19,500 tons displacement, to steam 13 knots, being built for Messrs. George Thompson & Co., Ltd., and also in a large ship for the Royal Mail Steam Packet Co.'s service to the South American republics.

The Orient Line ordered combination machinery for the Orama, laid down in 1910 for their Australian mail service. The vessel is 550 ft. long, and of about 18,000 tons displacement, and is being constructed and engined by Messrs. John Brown & Co., Ltd., Clydebank. All these ships have triple screws, each reciprocating engine driving a wing-shaft and propeller, while the turbine, taking the exhaust steam from both engines, works the center screw. This arrangement has the advantage that, in maneuvering and for going astern, the piston engines only are used, and thus there is no need for an astern turbine. At St. Nazaire, in France, an intermediate liner, the Rochambeau, is being built, and she has four shafts, the reciprocating engines driving the inner shafts and the turbines the wing propellers.

Reduction Gearing Between the Turbine and the Propeller.*

Several forms of gearing have been proposed. Electrical gearing was fitted, I believe, by the Heilmann company, in a small vessel about 13 years ago, but little is known of the results. Continuous-current generators and motors were originally proposed, but of late years some form of alternating current transmission has been preferred by the advocates of the system.

Within the last few months a 50-ft. vessel has been fitted by Henry Mavor, of Glasgow, with his form of alternating current generator and motor, and a suction-gas engine directly coupled to the generator. A quick reversal or graduation of speed of the propellers can be effected without alternating the speed of the engine by this method. The efficiency of the electrical transmission is said to reach 88 per cent. The same means of transmission is applicable to the steam turbine.

An hydraulic transmission gear has been developed by Mr. Fottinger, and has been fitted in two small vessels. The efficiency of transmission is said to reach 86 per cent. The first application of geared turbines was made by the Parsons Marine Steam-Turbine Co. in a 22-ft. launch in 1897. Double helical reduction gear between the turbine and the propeller has so recently been the subject of papers before this institution, that it is unnecessary to say more than that it promises to be an important factor in many marine turbine installations in the future. With an efficiency of over 98 per cent, and a remarkable absence of wear, it will add considerably to the efficiency of turbine installations even in fast vessels, and what is of greater importance, it makes the turbine applicable to all classes of vessels. The London & Southwestern Railway Co. has recently decided to fit two new steamers of 5,000 horsepower and 20 knots speed with geared turbines. They will have twin screws, and a high-pressure and a low-pressure turbine will be geared onto each screw shaft, similarly to the arrangement in the Vespasian.

Although the manufacture of land turbines began to be general on the continent in 1900, it was not till 1902 that the first turbine-propelled vessel was ordered by the French admiralty, a torpedo boat, length 130 ft., 94 tons displacement, and 26½ knots speed. She had three shafts, and the turbines, which were built by the Parsons Marine Steam-Turbine Co., at Wallsend-on-Tyne, were in series similar to those of the Turbinia, but with one cruising turbine coupled to the low-pressure turbine which drives the center shaft, and a reversing turbine in the low-pressure casing.

In 1906 a second vessel, the Chasseur, was ordered, a destroyer of 210 ft. length, 458 tons displacement, 9,000 horsepower, and 30.4 knots speed. Her arrangement of turbines differed from that of British destroyers, inasmuch as only one cruising turbine was fitted, and the machinery was arranged in two compartments, one abaft the other. In 1906 it was decided that the six battleships of the Danton class should be fitted with reaction turbines. The Danton was the first to be completed. She was built and engined by the La Seyne Works, of the Forges et Chantier Co. She is 475 ft. in length, 84 ft. 7 in. beam, and 18,374 tons displacement. The designed speed was 19.25 knots, with 22,500 shaft horsepower, but on her contract trial she maintained 20.66 knots in choppy seas, and during part of the run exceeded 21 knots. Similar results have been obtained in sister ships.

Two more battleships were laid down in 1910 of 542 ft. length, 23,467 tons displacement, and 20 knots designed speed with 28,000 shaft horsepower. Since 1908 the French admiralty have ordered no vessels with reciprocating engines. In 1909 a change was made in destroyer practice, all the boats being fitted with twin screws, and in some the combination impulse reaction turbines with an impulse-wheel followed by reaction blading.

The first marine turbines fitted in a merchant steamship built in France were made in 1908 at the works of Cie Electro-Mecanique for the Mediterranean steamer Charles Roux, of 9,000 horsepower and 19 knots speed. The trans-Atlantic liner France, of 688 ft. length, 25,460 tons displacement and 23 knots speed, with steam turbines of 40,000 shaft horsepower, is now approaching completion. The Newhaven for the Newhaven and Dieppe service has been completed, and has averaged 23.85 knots, mean of two cross-channel trips. There is also building in France the intermediate liner Rochambeau. In Germany the marine turbine was first introduced into the torpedo boat destroyer S 125, ordered toward the end of 1902. This vessel was one of the class of six boats ordered that year, the remaining boats having the ordinary type of reciprocating engines. In the following year the cruiser Lubeck was ordered by the German admiralty to be fitted with Parsons turbines. A series of comparative trials were made with this vessel and a sister vessel, the Hamburg, fitted with reciprocating engines. The results obtained on service of the destroyer S. 125 and the cruiser Lubeck, as compared with those of the sister vessels fitted with

*Paper on "The Application of the Marine Steam Turbine and Mechanical Gearing to Merchant Ships," by the Hon. C. A. Parsons, before the Institution of Naval Architects, March 18, 1910, and "Twelve Months' Experience with Geared Turbines in the Cargo Steamer Vespasian," by the Hon. C. A. Parsons and R. J. Walker, before the Institution of Naval Architects, April 5, 1911.

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reciprocating engines, were conclusive in favor of the turbine boats. The destroyer S 125 was fitted with the ordinary three-shaft arrangement of turbines, and also cruising turbines.

The turbines of the cruiser Lubeck were arranged on four shafts, each of which in the first trial carried two screw propellers. The shafts on each side of the ship are driven by a high-pressure aid a low-pressure turbine. Cruising turbines arranged in series were also fitted. An independent high-pressure reversing turbine was fitted to each shaft. This latter arrangement has not since been repeated; such reversing turbines are now always arranged and worked in series.

Following shortly on the completion of the S 125, the new destroyer G 137 was commenced. This vessel was the most powerful destroyer built up to that time in Germany, the turbine machinery arranged in two engine-rooms being nearly double the power of the S 125. Designed for a speed of 30 knots, she attained 33.08 knots on a three hours' run. All destroyers subsequent to the trials of G 137 have been fitted with turbines, and in some of the later vessels twin screws have been adopted. Meanwhile, following the Lubeck, the protected cruisers Stettin, Dresden, Augsburg and Ersatz Condor were equipped with turbine engines.

In 1907 the large armored cruiser Von der Tann was ordered to be built by Messrs. Blohm & Voss, of Hamburg, and she has been followed by the Moltke, Goeben and cruiser J. All these great cruisers are fitted with turbines of the Parsons type, with a four-shaft arrangement similar to that adopted in recent British armored cruisers. On her contract trials the Von der Tann developed about 80,000 horsepower, and attained a maximum speed of 28 knots.

Reciprocating engines were fitted in German battleships until 1909, when two vessels were ordered with steam turbines of the Parsons type. These vessels will be completed next year, and their trials will be of much interest, although their power and speed are inferior to those of the armored cruisers. It is understood that later battleships of 1910 and 1911 programs are also to be fitted with turbines. The Imperator, a new large liner building for the Hamburg-Amerika line by the Hamburg yard of the Vulcan, has Parsons (series) turbines, and Blohm & Voss are contracting for a second similar vessel for the same owners.

The first vessel to be fitted with Parsons turbines in the United States

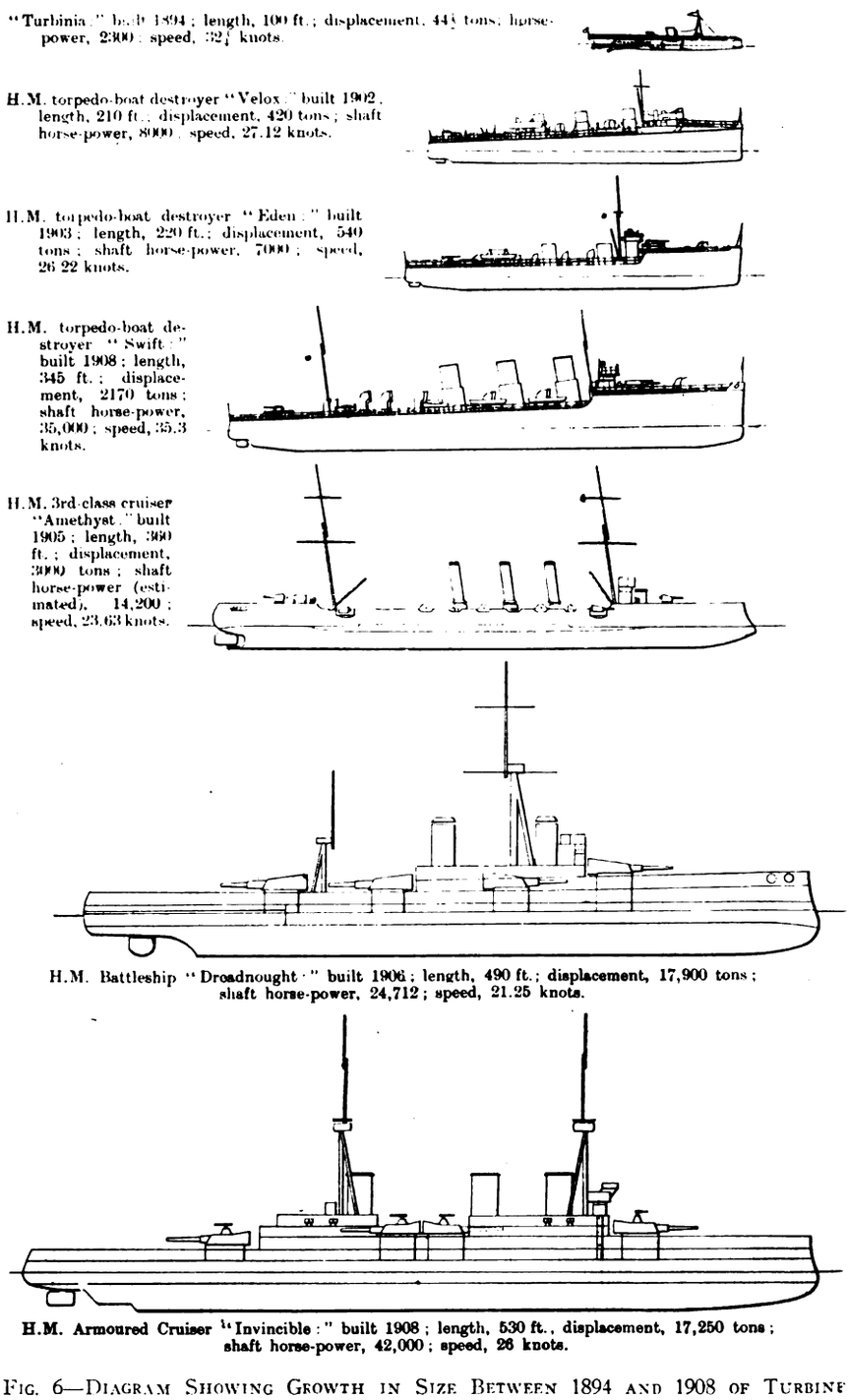
"Turbinia," built 1894; length, 100 ft.; displacement, 44½ tons; horse-power, 2300; speed, 32¼ knots.
H.M. torpedo-boat destroyer "Velox," built 1902; length, 210 ft.; displacement, 420 tons; shaft horse-power, 8000; speed, 27.12 knots.
H.M. torpedo-boat destroyer "Eden," built 1903; length, 220 ft.; displacement, 540 tons; shaft horse-power, 7000; speed, 26 22 knots.
H.M. torpedo-boat destroyer "Swift," built 1908; length, 345 ft.; displacement, 2170 tons; shaft horse-power, 35,000; speed, 35.3 knots.
H.M. 3rd-class cruiser "Amethyst," built 1905; length, 360 ft.; displacement, 3000 tons; shaft horse-power (estimated), 14,200; speed, 23.63 knots.
H.M. Battleship "Dreadnought," built 1906; length, 490 ft.; displacement, 17,900 tons; shaft horse-power, 24,712; speed, 21.25 knots.
H.M. Armoured Cruiser "Invincible," built 1908; length, 530 ft., displacement, 17,250 tons; shaft horse-power, 42,000; speed, 26 knots.

FIG. 6—DIAGRAM SHOWING GROWTH IN SIZE BETWEEN 1894 AND 1908 OF TURBINE PROPELLED WARSHIPS.

was the passenger steamer Governor Cobb. This vessel, built by the W. & A. Fletcher Co. in 1905, is 290 ft. long, 2,900 tons displacement and 20.5 knots speed. The arrangement of machinery is identical with that adopted in the King Edward. Following the Governor Cobb, the next vessels to be designed with turbines for passenger service were the Yale and Harvard, of 4,600 tons displacement, 10,000 horsepower and 22½ knots speed; the Old Colony, of 3,800 tons displacement and 20 knots speed, and the Camden and Belfast, of 1,820 tons displacement, with a speed of 19 and 18½ knots respectively. At about the same time as the Governor Cobb was ordered, the United States government placed the contract for three scout cruisers, Birmingham, with twin-screw reciprocating engines; Salem, with Curtis turbines, and the Chester, with Parsons turbines. The turbines of the Salem were arranged on two shafts, and in the Chester on four shafts in two enginerooms one abaft the other.

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Up to the time when the scout cruisers were ordered the Curtis type of turbine had been fitted only to a small vessel named the Revolution, and to the mercantile steamship Creole. It is understood that the turbines have since been removed from both these vessels. The Salem was therefore regarded as an experimental vessel, so far as the Curtis turbines were concerned, whereas the Chester with Parsons turbines represented one of a series of cruisers of which the Amethyst was the pioneer.

Cruising turbines in series were fitted in the Chester, one on each of the low-pressure turbine shafts. Astern turbines were only fitted on two of the four shafts, being incorporated in the exhaust casings of the low-pressure turbines. The comparative trials of these three vessels have from time to time been reviewed in leading technical journals. The contract speed was 24 knots and on the full-power trial the Birmingham attained 24.325 knots, the Salem 25,947 knots, and the Chester 26.52 knots.

In 1907, before the competitive trials of the scout cruisers were completed, the battleship North Dakota was ordered by the navy department from the Fore River Co., and it was decided to fit her with Curtis turbines of about 25,000 horsepower, her sister ship, the Delaware, being fitted with reciprocating engines. These two vessels were completed last year, and have been subjected to competitive trials both under contract conditions and on sea service.

Early in 1909, on the conclusion of the tests of the scout cruisers, the navy department decided to adopt the Parsons type of turbines for the new battleships now building—viz.: Utah, Florida, of the 1908 program, of 21,800 tons displacement and 28,000 horsepower, and later on the Wyoming and Arkansas, of 26,000 tons displacement and 30,000 horsepower. The trials of the Utah will take place shortly, and the future policy of the navy department in regard to battleships will doubtless be decided in view of the results obtained. Meantime, it has been decided to fit reciprocating engines in one battleship now building. Since 1907 all contracts for new destroyers awarded by the United States navy department have specified turbine engines.

In Japan four merchant vessels were fitted with Parsons turbines in 1908. Two of these, the Tenyo Maru and Chiyo Maru, were built at the Mitsu Bishi dockyard, at Nagasaki, the turbines for which were constructed by the Parsons Marine Steam Turbine Co., Ltd. Two others, the Hirafu Maru and the Tamura Maru, were built and engined by Messrs. Denny, of Dumbarton.

The volunteer steamers, Sakura Maru and Umegaka Maru were built and engined with Parsons turbines in 1908-1909 by the Mitsu Bishi Co. The Mogami, a despatch vessel for the imperial Japanese navy, was completed in the summer of 1908. There are also at present under construction for the imperial Japanese navy two cruisers and two high-speed destroyers with turbines of that type.

For larger warships the Japanese admiralty have adopted Curtis turbines in the Ibuki armored cruiser and Aki battleship, both of which were launched in 1907. Both these vessels have been tried and the results published. Subsequently it has been decided to adopt the Parsons type in the large armored cruiser now building for the Japanese navy by Messrs. Vickers, and in three sister ships to be built in Japan. The Japanese admiralty has also taken a license for the manufacture of the Parsons steam turbines in the national dockyards.

In Italy the cruiser San Marco is the first turbine ship for the Royal Italian navy. On her trials she attained a speed of 23.7 knots, being nearly two knots in excess of the speed attained by a sister vessel, the San Georgio, fitted with reciprocating machinery. The Citta di Catania and the Citta di Palermo, two passenger vessels of 3,500 tons displacement and 23 knots speed, were recently put on service for the Italian State Railway Co. At the present time there are under construction in Italy for the Royal Italian navy, Parsons turbines for four battleships, and several other vessels.

All the principal navies of the world are now following the lead of the British admiralty. In Russia, four large battleships of high power are under construction. In Austria, the scout Admiral Spaun was ordered in 1907, and on her trials she attained a speed of 27.07 knots, with 25,000 shaft horsepower. Three battleships and 12 torpedo boats are now on order in Austria with Parsons turbines, some of which are now building. Sweden and Denmark have recently ordered their first turbines for warships, a 7,000 horsepower set for a 21-knot cruiser in the case of Sweden, and engines of 4,000 horsepower for some twin-screw torpedo boats in the case of Denmark. In Spain, three battleships, three destroyers and ten torpedo boats, comprising the important recent naval program of this navy, are to be fitted with turbine machinery. Portugal is having one destroyer built. Brazil has now two turbine scout cruisers, Bahia and Rio Grande do Sul, on service. These two vessels on trial averaged a speed of 27¼ knots. The Argentine government is adopting turbines for its four new destroyers, now being built by Messrs. Cammell Laird & Co. China is having three small cruisers built. Belgium does not possess a war navy, but three turbine vessels have been built for the government passenger line, the Princess Elizabeth, of a speed of 24.03 knots, in 1905, and the two vessels, Jan Breydel and Peter de Connick, of speeds 24.3 knots. Peru possesses two passenger steamers, Huallaga and Ucayali, of 6,000 tons displacement and 19 knots speed. The British colonies of Canada, Australia and New Zealand are having various classes of war vessels fitted with the turbine system.

The Newport News Shipbuilding & Dry Dock Co., Newport News, Va., has been awarded contract to install Babcock & Wilcox boilers in the battleship New York, which is to be built at the Brooklyn navy yard. The Texas, a sister ship, building by the Newport News company, will also have Babcock and Wilcox boilers.

Parsons Turbines Completed and Under Construction.

	War vessels.		Mercantile vessels.		Yachts.		Total.	
	No.	H. P.	No.	H. P.	No.	H. P.	No.	H. P.
Great Britain and colonies	156	2,480,300	62	631,000	6	17,000	224	3,128,300
United States	25	392,000	6	40,000	4	12,200	35	444,200
Germany	26	757,600	1	60,000	..	.....	27	817,600
France	18	292,800	4	62,000	..	.....	22	354,800
Japan	7	213,100	7	76,000	..	.....	14	289,100
Italy	9	163,100	2	24,000	..	.....	11	187,100
Brazil	3	38,400	..	.....	..	.....	3	38,400
Argentine	4	72,000	..	.....	..	.....	4	72,000
Peru	...	.....	2	15,000	..	.....	2	15,000
Chili	2	50,000	..	.....	..	.....	2	50,000
China	3	19,000	..	.....	..	.....	3	19,000
Portugal	1	11,000	..	.....	..	.....	1	11,000
Sweden	1	7,000	..	.....	..	.....	1	7,000
Denmark	2	8,000	..	.....	..	.....	2	8,000
Spain	16	102,500	..	.....	..	.....	16	102,500
Rusia	4	168,000	..	.....	..	.....	4	168,000
Austria	4	95,000	..	.....	..	.....	4	95,000
Belgium	...	.....	3	34,000	..	.....	3	34,000
Total	281	4,869,800	87	942,000	10	29,200	378	5,841,000

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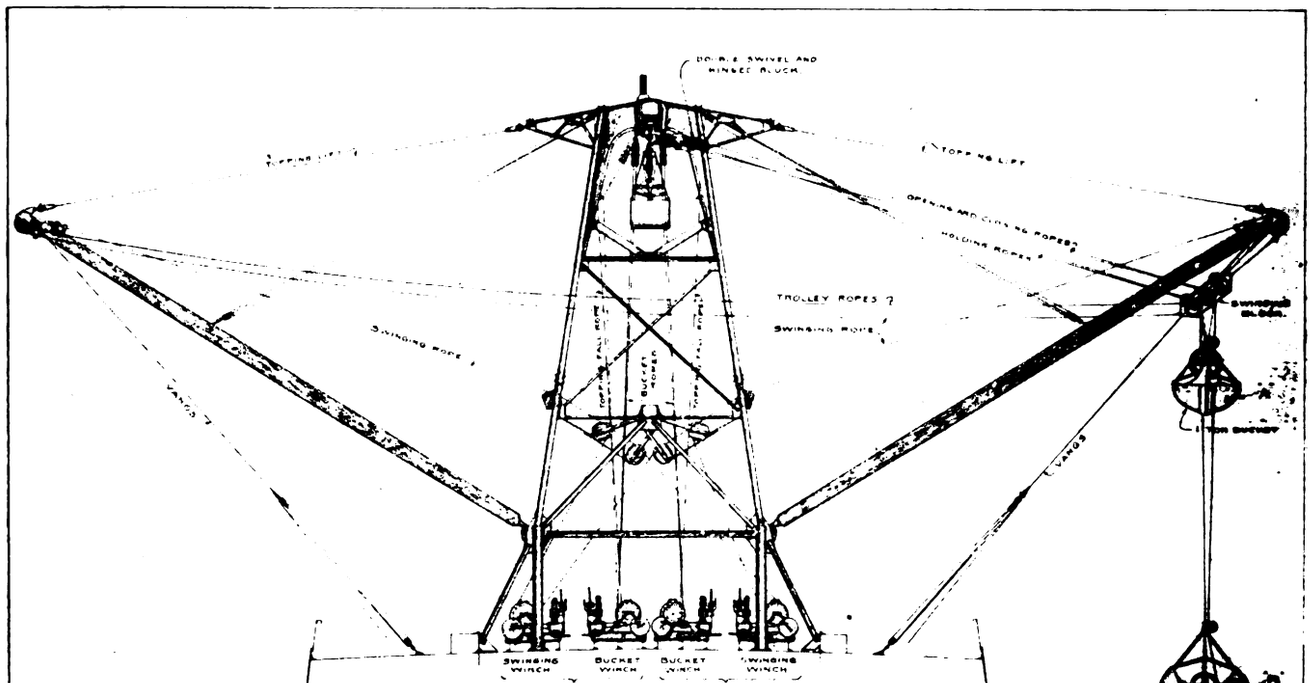
Coal Handling Gear on the United States Collier Neptune

THE Maryland Steel Co. was awarded the contract for building the collier Neptune. They studied and considered all of the available known types of coal-handling gear in use both on ship and on shore. After thorough consideration of all the available methods they adopted the marine transfer because the marine transfer presented an opportunity to employ the most economical form of structure on board the ship both in weight and in cost of fabrication. They constructed square booms of steel instead of the round ones which have been used heretofore. They also installed a structural steel mast or tower in place of the usual round steel mast. Instead of tying these structural steel towers or masts together with a flexible member as on the colliers Vestal and Prometheus, they have employed a stiff member of inverted "U" section. This member is used for two purposes. It forms a trackway running lengthwise of the ship and it also forms a support over each hatch for the overhead block of the marine transfer. A carriage running on this girder enables one to pick up coal from any of the hatches and deliver it to any other hatch or to the bunkers of the collier. A cross-section is shown in the illustration. This shows how the booms are rigged outboard and supported for the operation of the marine transfer. It also shows the simplicity and adaptability for the purpose for which it is used, namely, to transfer coal from the collier to a battleship alongside.



The Lidgerwood Mfg. Co. designed a new type of winch and control for operating the clamshell bucket in its vertical and horizontal motions. With this type of control one winch hoists the bucket vertically and the other swings it horizontally in either direction. The two winches are independent of each other and can be worked separately or in unison, each two winches being controlled by one operator. Only three levers are involved in the operation of the two winches, a hand and a foot lever for the bucket winch and a simple hand lever for the swinging winch. This control is extremely simple. Lifting a lever on the bucket winch causes the bucket to be raised, lowering the lever lowers the bucket and putting the lever in mid-position stops the bucket. The swinging winch is operated in the same manner. Lifting the lever swings the bucket outboard, lowering the lever swings the bucket inboard. When this lever is placed in mid-position a steam brake is automatically set which will hold the swinging block or carriage so as to prevent movement of the bucket in either direction due to its load. Each winch has two drums. In the bucket winch the closing rope is attached to one drum and the holding rope on the other. In the swinging winch one drum operates the inhaul, the other the outhaul. The friction drums have patented metallic frictions with air cooling passages of the Spencer Miller type. These frictions are not affected in any way by heat or weather and their lifting power remains practically constant.

Owing to the limited space aboard ship and the amount of power it requires to operate the clamshell bucket smoothly and rapidly it becomes necessary to use high steam pressure. Because high steam pressure is em-

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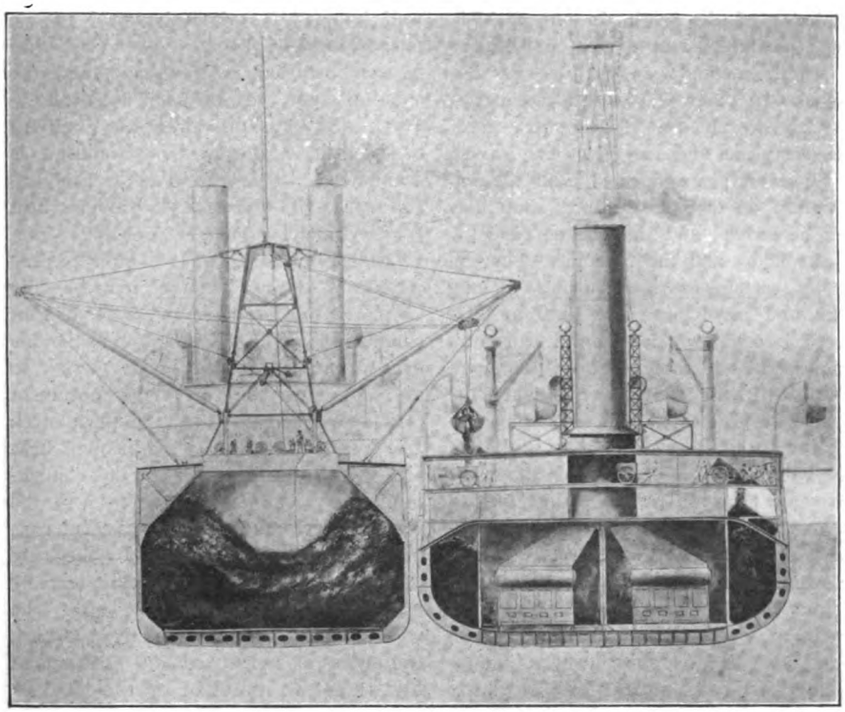


SHOWING THE MARINE TRANSFER AS IT OPERATES IN COALING A WARSHIP.

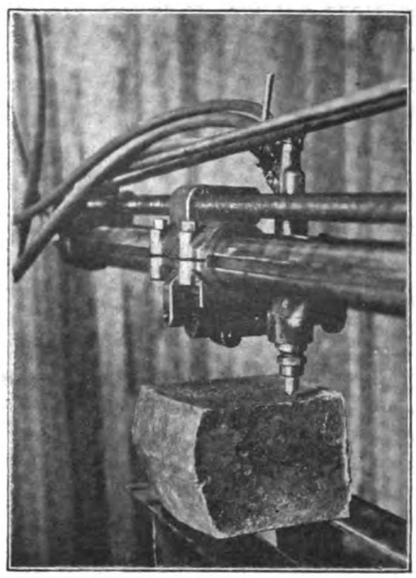
ployed, namely, 150 to 175 lb. per square inch, piston valves are used which are a novelty in winch construction for ships' use. With the employment of piston valves almost perfect balance is obtained. The friction of the valve is so small that the troubles which are experienced with eccentric rods on ordinary high pressure winches are entirely eliminated. Excessive wear is also avoided, which makes the piston valve desirable aboard a ship when only a few men are available for repairs or adjustment. The gears on all of the winches are of steel. The pinions are of bronze and both have machine cut teeth. This makes a most efficient and practically noiseless running winch and makes for efficiency and reliability. If these winches had been supplied with regular rough cast gearing the noise of the winches operating upon a metallic deck would be prodigious and the capacity would be somewhat diminished owing to less efficiency. It would also be impossible to hear orders.

During the preliminary trials by the Maryland Steel Co. round trips were made as rapidly as two per minute from the bottom of the hatch, while 100 to 110 trips per hour will deliver the required guaranteed capacity.

Acetylene Welding and Cutting Machine

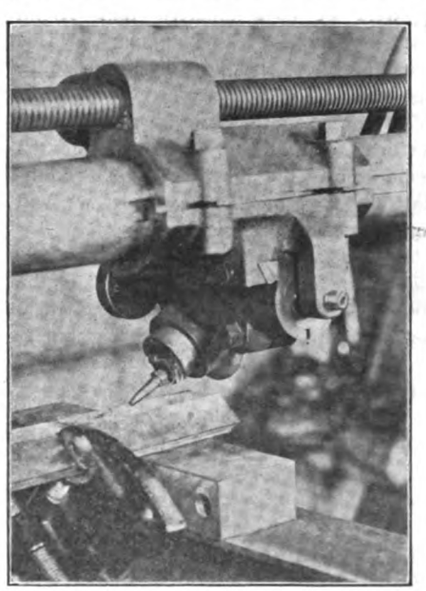
HAND welding and band cutting are now familiar operations to which the acetylene blow-pipe is highly adapted. Where straight-line operations have to be carried out, especially in connection with repetition work, a machine is often applicable and advisable. Where sheets are very thin, machine welding is very desirable because of the certainty with which it can be regulated. The machine can be advantageously used in sheet metal work, where the thicknesses range up to, say, $\frac{1}{8}$ or $\frac{3}{32}$ in. Straight cutting of both thin and thick work can be advantageously done with the machine because of the precision of the movement.

An acetylene welding and cutting machine has recently been built by the Davis-Bournonville Co., of 90 West street, New York City, at their laboratory at Marion station, Jersey City. The patent rights involved are held by this concern. There is a cylindrical upright perhaps 6 or 7 ft. in height. This carries a long hollow arm projecting for 6 or 7 ft. on one side. By means of a rack and pinion, this arm may be adjusted to any height desired. The arm carries a long screw, rotatably and horizontally mounted in suitable bearings. At the base of the upright, loose and tight pulleys are mounted on a



A HEAVY CUTTING OPERATION.

short horizontal shaft and are driven from an ordinary countershaft above. At one end of this short shaft, a friction pinion is arranged, which contacts with a suitable disk mounted on a vertical shaft. This latter shaft and a



ANGULAR WORK IN WELDING POSITION.

rotatable rod arranged in the hollow arm are put into driving connection by bevel gears. At the outer end of the arm, an arrangement of gears enables the inclosed rod to drive the screw. The turning of this screw operates a

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carriage back and forth horizontally along the arm. Upon the carriage, the torch and its controlling fixtures are mounted. The work is placed or secured on a suitable fixed table. Flexible tubes bring the oxygen and acetylene to the torch. The tip is practically the ordinary form. It is arranged at an angle, say 40 or 45 degrees, to the horizontal, this angle being to the rear of the welding movement. The torch then moves over the work much after the way a cowcatcher passes along over a railway track.

The method of welding is often quite simple. Thus, if the weld is to be a flat one and of inconsiderable length, the two pieces are simply clamped in the exact relative positions they are to occupy finally. Room must of course be left for the tip to pass. The operation of welding is then not unlike that which occurs with an ordinary shaper. The carriage with the torch moves evenly along at the proper rate of speed. The countershaft, running at say 140 R. P. M., operates the short horizontal shaft at about 70 revolutions. It is possible to adjust the friction pinion to vary the angular speed of the vertical shaft from about 70 to about 35 revolutions. Still further reductions of speed may be made by the gears at the end of the arm. Indeed, quite a range of speeds may be obtained by suitable combinations of the gears. The screw has about six threads to the inch and gives the carriage a speed which means that a weld of approximately that length may be made. If an angular weld is to be formed, the only difference to be made is in the arrangement of the work. The angle opens downwards and the vertical plane through the line of the weld bisects the dihedral angle. To illustrate by a practical example, we will suppose that it is desired to weld two strips edge to edge at an angle of 90 degrees. We place the strips on the sides of an angle bar, clamping them securely in position with clamping strips inserted between the outer faces of the work and the jaws of the clamps.

There is an economy which is possible with hand welding, and which will probably come into pretty general use where the machine is used. The object of using an oxy-acetylene torch is for the purpose of getting a very high temperature. Because of the enormous temperature of about 6,000° Fahr., which is claimed for the working point of the little inner flame, this torch is very successful in bringing steel and other metals locally to or near the melting point. Ordinary flames are incompetent to this. But the ordinary—and cheap—flame is competent to supply a large amount of the requisite heat. Where the form and character of the work do not prohibit, there seems no reason why pre-heating by cheap methods should not be employed. In other words, it is not necessary to do all the heating with gases like acetylene and oxygen. The saving is, however, not connected with the consumption of the gases alone; time may also be saved; and this means economy of the labor and the machine. For example, certain work requiring a long seam and involving sheets 0.10 to 0.12-in. thick can be welded on a European machine at the rate of about 12 in. per minute. Practical experiments where the work was pre-heated before passing under the torch showed, so it is said, that the work—and I understand it to be the same class of work—can be welded at a speed of 26 to 28 inches per minute. The economy in time is striking. The methods of pre-heating may be various. Thus, if it is a question of small repetition work, the pre-heating may in some cases be done subsequent to clamping but prior to putting the work on the table. Other cases will require pre-heating with the work in welding position. In general, the pre-heating arrangements will not be difficult to provide. Pre heating is to be recommended strongly for the two reasons—economy of oxygen consumption and reduction of effects of expansion and contraction.

The machine already described as a welding device can readily be used as a cutting apparatus. The high precision of the motion of the carriage recommends it for this purpose. In cutting, however, some variations are made. In the first place, the jet arrangements are different. But this is perhaps more a matter of simultaneous development, as the new arrangement of jets will no doubt be effective as a hand tool. On the machine, three jets are arranged in a rigidly vertical position, the gases being driven directly downwards. These are arranged in line with the direction of movement. Ahead is a heating jet of oxygen and acetylene; at the rear is another but smaller heating jet. Between the two, the cutting jet of oxygen is arranged. Three flexible tubes bring the gases. An oxygen and an acetylene tube together supply the gases for the two heating jets. Thus these jets are both supplied from the same sources. An independent oxygen supply is provided for the cutting jet, for the reason that ordinarily the pressure back of this jet is higher—and sometimes, much higher—than is the case with the heating oxygen. By the foregoing arrangement of jets, a strong heat is provided just ahead of the cutting oxygen, and a moderate one just behind. The office of the jet ahead is pretty well known; it raises the steel to the temperature of combustion. The pure oxygen then enters the game, and the metal is "cut." It has been found, however, that by providing an auxiliary heater behind, the work of cutting is facilitated. Its operation is probably as follows: The forward jet provides heat for the metal which is probably somewhat lost by the time the pure oxygen jet comes along. This jet may be only ⅛ in. behind. Still it would seem that conduction would carry off considerable heat while the cutting jet is getting to the spot, especially where the movement is a slow one, as with very thick steel. The rear jet provides additional heat and thus reduces dissipation by conduction. Its scene of operation is in the region where much of the wasteful conduction would take place. In the case of thin plates, the rear jet is scarcely necessary and may be shut off. The whole arrangement is readily replaced, and thus is permitted an economical adjustment to the size of the work.

Anti-Rolling Tank

Hermann Frahm, the Hamburg dock manager, has invented and placed upon the market an anti-rolling tank which has proved by practical experiment to be a potent preventer of sea-sickness. These tanks were first installed and tried in the spring of 1910 on the steamers Ypirango and Corcovado of the Hamburg-American Line. The German Mail steamer General of the German-East African Line was the next to be equipped and it is stated that on all three boats the expectations of the inventor were realized. In an illustrated paper recently issued by Herr Frahm the success of his tank was attested by reference to numerous large passenger steamers which the Hamburg-American Line has decided to equip with tanks. They are being installed on the following of its vessels: Kaiserin Auguste Victoria, Amerika, Cleveland, Cincinnati, the new tourist steamer Victoria Luise and the huge quadruple screw steamer Imperator, and her sister ship which are now under construction. The Hamburg-South American Steamship Co. has ordered the device for its large steamer, the Cap Finisterre, and the Woermann Line has also ordered an equipment for the steamer Henny Woermann. In the pamphlet the causes of rolling of vessels in heavy seas and the design of the anti-rolling tanks is dealt with at length.

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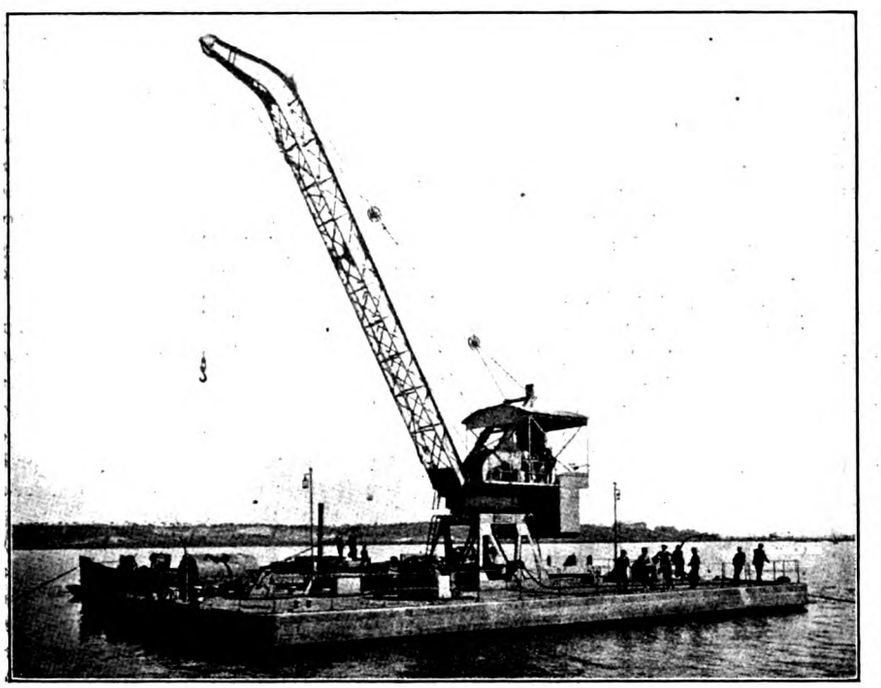
Floating Crane for Unloading Ore

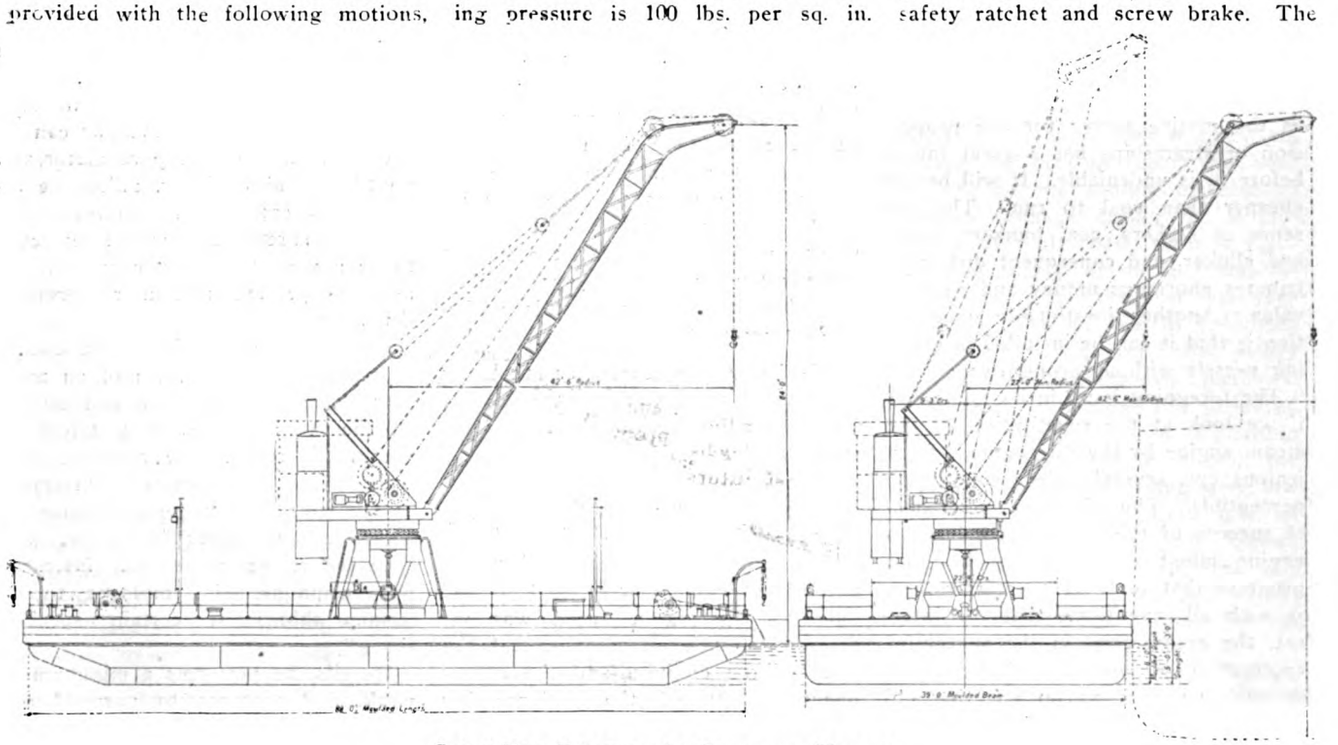
THE firm of John H. Wilson & Co., Birmingham, Eng., has just completed a floating crane and barge for unloading mineral ore at Huelva, Spain. The crane is designed to lift 7 tons at 42 ft. 6 in. radius and is provided with the following motions, all worked by steam lifting and lowering, revolving, jib adjusting and warping. The boiler, which is of the vertical cross-tube type, is 4 ft. in diameter by 9 ft. 6 in. high and is fitted with three cross tubes. The working pressure is 100 lbs. per sq. in.



FLOATING JIB CRANE FOR SPAIN.

The engine cylinders are 8 in. in diameter by 12 in. stroke, and the length of the jib is 60 ft. The speed of lifts with full load is 80 ft. per minute and with light loads 200 ft. per minute; the speed of revolving is one revolution in 40 seconds. Luffing from the maximum radius of 42 ft. 6 in. to a minimum radius of 22 ft. can be carried out in 15 seconds. The engines have double cylinders with link motion reversing gear fitted with cast steel quadrant links and gun metal eccentric straps. The lifting gear is arranged with single and double purchases and two powerful foot brakes have been provided to give full command over the maximum load. The barrel is 21 in. in diameter and is grooved for wire rope. The load is lifted on a single rope with a swivel hook. The lifting pinion can be slid out of gear so that the barrel may run free when lowered in single purchase.

The revolving gear is actuated by means of double friction cones controlled by a screw brake and worked by a hand wheel and screw so that the crane can be revolved in either direction without reversing the engines. The rack and roller path are bolted to the foundation and made in halves. The jib adjusting gear is capable of adjusting the jib between a minimum radius of 22 ft. and a maximum of 42 ft. 6 in. and consists of a spur gear drive from the lifting shaft to the luffing barrel shaft, the gear being controlled by means of a safety ratchet and screw brake. The



SEVEN-TON FLOATING JIB CRANE FOR HUELVA.

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jib is raised and lowered by means of a steel wire rope 1¼ in. diameter. The jib is made of steel, braced at intervals in its length, and is 60 ft. long from center to center. It is spread out at the base and takes its attachment at the extreme width of the bottom center casting. A double tropical awning of galvanized corrugated iron is fitted over the boiler, gearing and drivers' platform, and is provided with rods from which awnings or screens may be hung.

The barge on which the crane is mounted is 90 ft. over all, 39 ft. molded beams, 41 ft. over fenders, and 8 ft. deep. It is constructed of mild steel and has a sloping bow and stern. A wooden fender extends all around the vessel, which is provided with a hand winch at each end for warping purposes. Two warping drums capable of exerting a direct pull of 3 tons are fitted, one at each side of the bottom structure of the crane, and are arranged to be driven by the crane engines. The frames are made of angle steel 3 in. x 2½ in. x 6/20 in. They are spaced 24 in. apart and are in one length from keel to gunwale. A keel piece 24 in. long is fitted in center on the reverse side. The floors are of steel plate ¼ in. thick. The reverse frames are composed of angle steel 2½ in. by 2½ in. by 5/20 in. and are riveted to the top of every floor. The beams are of angle steel 4 in. by 2½ in. by 6/20 in. and are connected by bracket plates 6/20 in. thick to every frame. The barge is braced below deck with four athwartships and two fore and aft bulkheads constructed of steel plates and stiffened by angles. The bottom and bilge shell plating is 5/16 in. thick and that of the sheer strake ⅜ in. thick. All the seams are lapped and single riveted while the butt joints are overlapped and double riveted. The gunwale is of angle steel 4 in. x 2½ in. x 6/20 in.

The crane and barge are arranged so that with the load at maximum radius or with load at minimum radius, the angle of cant of the barge is not greater than 1 degree. When fully loaded the freeboard is not less than 3 ft.

The Coming of "The Oiler"

By J. T. Towlson.

THAT is the name, "The Oiler," by which a ship propelled by means of an internal combustion engine will, early, be known. Steam engine driven ships are "steamers," therefore, oil engine driven vessels are, of course, "oilers."

That the internal combustion engine as the motive power for the propulsion of steamships has a great future before it, is undeniable. It will be far cheaper than coal to run. The absence of stokers, coal bunkers, ashes and clinker, and consequent dirt, contributes enormous money and comfort value. Another inestimable qualification is that it can be installed in existing vessels without prohibitive cost.

The foregoing is all in its favor, but if we look at the substitution of the steam engine by the oil engine, with a jealous eye, several objections will be perceptible. The adoption and general success of the internal combustion engine afloat is making such rapid progress that there is a great danger, as with all inventions, that the interest, the enthusiasm, in the successful application of the general principles of such will act as an effective obscurator of the meed for considerably more careful attention being paid to several comparatively neglected, but important details, the absence of such attention being more than liable to prove a contributing factor in the "spelling of failure" to the whole. Foremost among these is the provision of some means for the prevention of racing due to a bad sea, a broken shaft, or lost propeller, and as we may judge from information and details which have been made public, this appears to have been almost entirely ignored. Doubtless, several makers have given the subject some attention, but greater application should be given to this all-important matter.

We know, we remember, that for many years there were no trustworthy means of adjusting the throttle of the steam engine; and the watch engineer was required to devote the whole of his time, and, at times, the whole of his physical strength to this, with the ship in a bad sea, sometimes for days and nights consecutively, and it was only as the piston speed was increased to such an amount, and the sizes of the engines, and the consequent weight of the reciprocating parts, arose far in excess of that dreamed of by the early engineers, that a mechanical governor became absolutely necessary.

Engineers of middle age remember the disaster and collapse of one set of engines of the Inman liner the City of Paris, some fifteen years ago, due only to a fractured shaft and the loss, in consequence, of a propeller. Damages to the extent of over £14,000 resulted, and only on her second voyage.

This provided a lesson to engineers responsible for the safety of ships which will never be forgotten; and though there is probably, at least, one device which can be trusted to take full charge of the speed of the engines from Queenstown to Sandy Hook, it is to be feared many engines would be in sad case with a broken thrust shaft or lost propeller, even now. Surely those interested in the entire success of the internal combustion engine do not need such an example as was given to steam engineers by the catastrophe to the fine vessel referred to; and it is time they devoted earnest attention to the problem if their engine is ever to successfully rival the "steamer".

Doubtless, to apply a monitor or governor to the motive power of an oil-driven vessel is a tougher task than to provide a steam-driven ship with such an appliance. There is no need to recount the reasons, for they are obvious; but it may be good to remind those interested, that something which is immensely in advance of what is generally considered a good governor is demanded. Governors of the ordinarily accepted class will be found worse than useless—a rotten stick on which to lean.

It must be recognized as axiomatic that no direct-acting governor can be a close and trustworthy regulator, and no thoughtful engineer, unless he allowed his enthusiasm to obscure his practical shrewdness, would expect it to be any more than a comparatively useful expedient and a compromise generally.

Let the function of a steam engine be presented in the form of an analogy: "A merchant, quick and critical, sits in his office with a telephone within his reach. He receives, with little effort or movement, messages continually; and in consequence of what such messages imply he, with little effort or movement, instructs, per telephone, his employes to do certain things at certain specified times."

He sits, he performs a minimum of work, and "returns to normal" and waits. So it is or should be with a

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governor; and when applied to a steam engine should comprise a set of balls, quick and sensitive, with an unalterable frictional or other load, and driven by unfailing methods at a pre-arranged and precise relative speed from the prime-mover shaft.

This light and sensitive part—the rotating balls—should have a simple and unvarying function to perform, and requiring an infinitesimal amount of power to perform such a function. The duty referred to would be to always stand as a monitor, for the purpose of instructing some other, but superlatively powerful part—"what to do," "when to do it," and "to what extent". And to do this the small and sensitive part must have no mechanical connection with the powerful part, but, after telling such powerful part "what to do, etc," it must be its natural and unfailing function, after altering its plane of rotation an infinitely small amount, to return to its normal place.

It is evident that from these premises, the speed of the engine must temporarily, though, very slightly, vary, and, at every change of load will fluctuate a little high, or a little low, as the case may be. But (and here lies the sterling value of the principle, or system) the engine speed will, after one or two fluctuations, above and below, return to normal, and the sensitive rotating part will also settle at its normal plane of rotation, and the controlling valve of the engine will be compelled to remain in its correct position consistent with the load on the engine. Moreover, the sensitive part will always wait for other calls which may be made (momentarily or hourly) on its office, as a monitor.

Should work be suddenly taken off the engine, steam will be cut off in excess of actual needs, and the speed of the engine will be brought down, slightly below the normal, and then it will rise a less amount above, and thus in each succeeding second will decreasing fluctuations of speed of engine occur, until all is normal again.

Though the writer is fully aware of the difficulty of the application of an efficient governing appliance to ships' machinery, generally, and to ships fitted with internal combustion engines in particular, he is of opinion that any successful system of close regulation should be as closely identified with the principle laid down as it is possible to apply it.

The Design and Performance of the Trans-Pacific Liners Tenyo Maru and Chiyo Maru*

By Professor S. Terano, Member, and Professor Baron C. Shiba, Member.

THE passenger traffic on the Trans-Pacific route between San Francisco and Hongkong, via Japanese ports, has largely increased of late years, and the long-felt want of high-class passenger steamers on the service under the Japanese flag was realized by the building of the Tenyo Maru and Chiyo Maru. They were built at the Mitsubishi Dockyard and Engine Works in Nagasaki to the order of the Toyo Kisen Kaisha; both of them were launched in 1907, and commenced running the following year. These two steamers are not only the largest yet produced in the east, and the first turbine steamers in Pacific waters, but they also present many noteworthy features in both design and appointments.

The principal dimensions are:—

Length between perpendiculars, 550 ft.; breadth molded, 63 ft.; depth molded to upper deck, 38 ft. 6 in.; depth molded to shelter deck, 46 ft. 6 in.; load draught (to Lloyds summer freeboard) 31 ft. 8 in.; load displacement, 21,660 tons; gross tonnage, 13,454 tons.

They are of the complete shelter-deck type, built to Lloyds highest requirements, with promenade and boat decks covering nearly half their length amidship, thereby giving accommodations for first-class passengers. The total numbers of passengers carried are 260 first-class, 47 second-class, and 816 third-class. The deadweight carrying capacity is 10,330 tons, and cargo capacity 8,700 tons at 40 cubic ft. per ton; capacity for stores and lockers is 1,400 tons, including cold storage of 240 tons.

As these steamers trade on semi-tropical routes, special care has been taken in the arrangement of state rooms, all rooms being extra large—8 ft. by 11 ft. and 9 ft. by 12 ft.—and inner rooms avoided, except a few on the lowest passenger deck, where they have but a single berth. The ventilation throughout the steamer is assisted by 15 thermo tanks, which can also be used for heating all living quarters in cold weather. Of the 12 water-tight bulkheads, four are fitted with automatic water-tight doors on the "long arm" system.

These vessels are driven by Parsons steam turbines with three propellers, and have 13 single-ended boilers, 15 ft. 9 in. diameter, with total grate surface of 981 square ft. The mean speed attained on trial, at the draught of 24 ft. 9 in., was 20.6 knots, with shaft H. P., as measured by a Denny-Johnson torsion-meter, of about 20,000. In ordinary sea condition they can easily maintain a mean speed of 18½ knots with 12 boilers.

One of the novelties in them is the adoption of oil fuel, and it is the intention of the present paper to deal with details of this installation, and show the results of actual performances. The merits of oil fuel as against coal are too well known to be repeated here, and it is only on account of the uncertainty of its supply and of its higher cost that oil fuel has never come into more general use. Vessels burning oil fuel are mostly restricted to those navigating in the oil districts.

At the time when the building of these two steamers was decided on, the price† of coal in Japan was very high, due to the sudden increase of steamship tonnage during the Russo-Japanese War of 1904-5, while in California the supply of oil fuel was almost limitless, and the cost was very moderate.‡ The oil field in California is very extensive, and the yearly production has enormously increased of late years. But crude oils produced from this district are of asphaltum base, and comparatively heavy, the percentage of light oil being very low when compared with crude oils of the eastern districts of the United States. Some of the California oils are too thick to be of any use except for fuel. These facts account for the abundant supply.

*Read at the Jubilee meetings of the Institution of Naval Architects.

†About 8 yen ($4.00) per ton.

‡50 cents per bbl. of 330 lb.

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As it seemed in every way advisable to adopt oil for fuel, minute investigations were made with regard to the quality of the Californian oil, and the methods of carrying and stowing it; also into the different systems of burning. When it was finally decided to use oil for fuel the supply was contracted for, specifying quality as to density and flash points. The former was fixed at 16 to 18 Beaumé, and the latter at about 150 degrees Fahr.; a higher flash point was found an unnecessary precaution, and it made the oil too expensive. The decision proved to be fully justified by the results obtained in actual service.

Double-bottom tanks are arranged to carry either oil or water ballast, but, with a view to secure absolute safety, oil is not carried under boilers or engines; also in order to avoid any probability of leakage due to panting action, the foremost tank is not fitted for oil. The amount carried in bottom tanks is thus about 630 tons. Two deep tanks, one in front of the forward boiler room, and the other between the forward and after boiler rooms, are constructed to carry oil; the capacity of the forward tank—extending to the main deck—is 1,165 tons, and that of the upper main tank, between the upper and main decks, is 500 tons, while the lower main tank, i. e., below the main deck, contains 1,120 tons. There are two oil settling tanks, built inside the main oil tank, each of 130 tons capacity, equivalent to one day's consumption. Heavy oil is always mixed more or less with water, and can only be separated by keeping it perfectly still in the settling tank and allowing more than 12 hours for the water to settle down at bottom of the tank, from which it can be drained off. Thus, the total capacity for oil storage is 3,675 tons, a quantity sufficient to run the ship for about 27 steaming days at an average service speed of 15 knots, or to cover the distance of about 10,000 miles.

The supply of oil fuel is neither so certain nor so universal as in the case of coal, and this fact was borne in mind when scheming out the oil installation of these steamers. Thus deep tanks were so constructed that they could be converted with little trouble to carry coal also; all coal-holes and doors for this purpose were temporarily covered up with detachable plates securely riveted to the bulkhead plating and caulked round.

Deep tanks and double-bottom tanks are constructed according to Lloyds requirements for oil carrying; seams of deck, tank top, and bulkhead plating are all double riveted, and the use of red lead putty, or other packing materials for securing water-tightness avoided as much as possible. Rivets connecting frame gussets to tank top, and also those connecting side bracket to margin plate, are countersunk headed and caulked from inside to tank.

A dry cofferdam is fitted at the front end of the forward oil tank, extending for a length of one frame space, to keep the cargo hold clear of any leakage of oil from the tank, oil gutters have been constructed on boiler room sides of tanks, extending from side to side of the ship, where oil valve boxes are placed, and any oil leaking from tank bulkheads or from pipe joints is collected, washed down with the hose and pumped overboard at regular intervals of time. There is also an oil well at each end of the double-bottom oil tank, to prevent any possibility of oil leaking into ordinary ballast tanks.

Ventilation of oil tanks is also very carefully done throughout. The gas emitted from oil is very heavy and very difficult to remove by ordinary methods of ventilation, and as there is no danger of explosion, so long as the tanks are kept perfectly tight, no ventilator pipes are fitted, except small air pipes serving as exhausts for air in filling the tanks. When it is deemed necessary to clear the tanks, as in the case of inspection or repairs to be done to the tank, artificial means of sucking air through the oil suction pipes are provided. For this purpose, the connection can be established between one of the boiler room blowers—fitted for supplying air to atomize the oil, as will appear later on—and the oil suction main by means of a flexible hose. Clayton's fire extinguisher is also made use of in assisting the ventilation of deep oil tanks, and is fitted with branch pipes leading down to different depths in the tanks, thus enabling the Clayton's blower to draw out gas from any desired height; only small quantities of gas can thus be dealt with.

The tank suctions from each double bottom are led to separate valve boxes, one for each side of each tank, through which they are connected to ballast and oil main suction. These valve boxes are so constructed that one tank can never be connected to oil and water ballast main at the same time, thus avoiding any possibility of oil and water mixing. There are two oil mains of 6 in. diameter, one for each side, and they are again connected through valve boxes to the ballast pump suction and delivery pipes. One of the ballast donkey pumps, 9 in. by 12 in. by 10 in., of

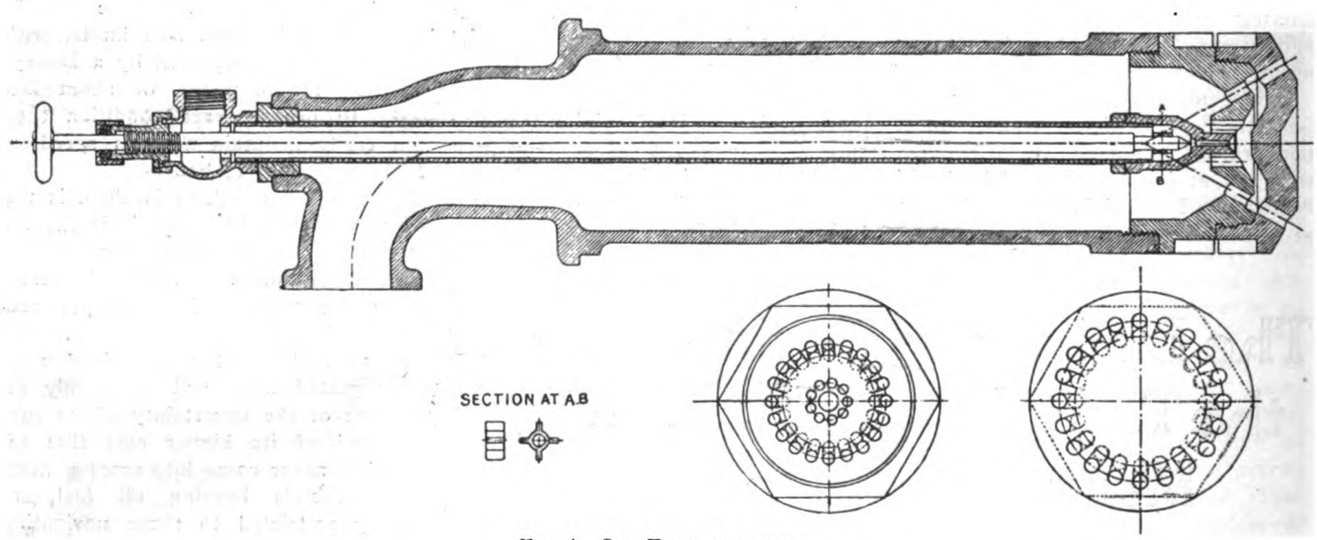

FIG. 1—OIL FUEL ATOMIZER.

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which there are two, is exclusively used for pumping oil, being cross connected with the water ballast pump with blind flanges in the middle. This pump can shift oil from one tank to another, or deliver into the settling tanks; trim can thus be adjusted by oil ballast.

After carefully considering the different systems of burners, it was concluded that none using steam is economical for an ocean liner, as a large installation of evaporators is needed for making up the deficit of fresh water lost by atomizing the oil, and fuel consumption is far greater than as it has comparatively large holes, the tendency to choke is less; further, its adoption of low pressure air for atomizing greatly reduces the trouble of working the air compressors. Thus, after due consideration, Lässoe's burners were fitted in the two steamers, and their construction and arrangements are as shown in Figs. 1 and 2. The quantity of atomizing air and oil can be nicely adjusted by cocks provided for that purpose; a small steam pipe is led to each burner from the boiler, and this was found to be very useful for blowing out the nozzle whenever choked.

very useful, especially in winter. Strainers are provided on both the suction and delivery sides of the fuel pumps; they are arranged in duplicate for the purpose of overhauling and cleaning. Delivery pipes from the pumps, after leaving the strainers, are led to the heaters, and then form a ring around the boilers in each stokehold. In the ring an escape valve is provided, and its drain is connected to the suction of the fuel pump.

Oil heaters are also made duplicate, and one set is placed in each stokehold. They may be connected either in series or in parallel, and by this

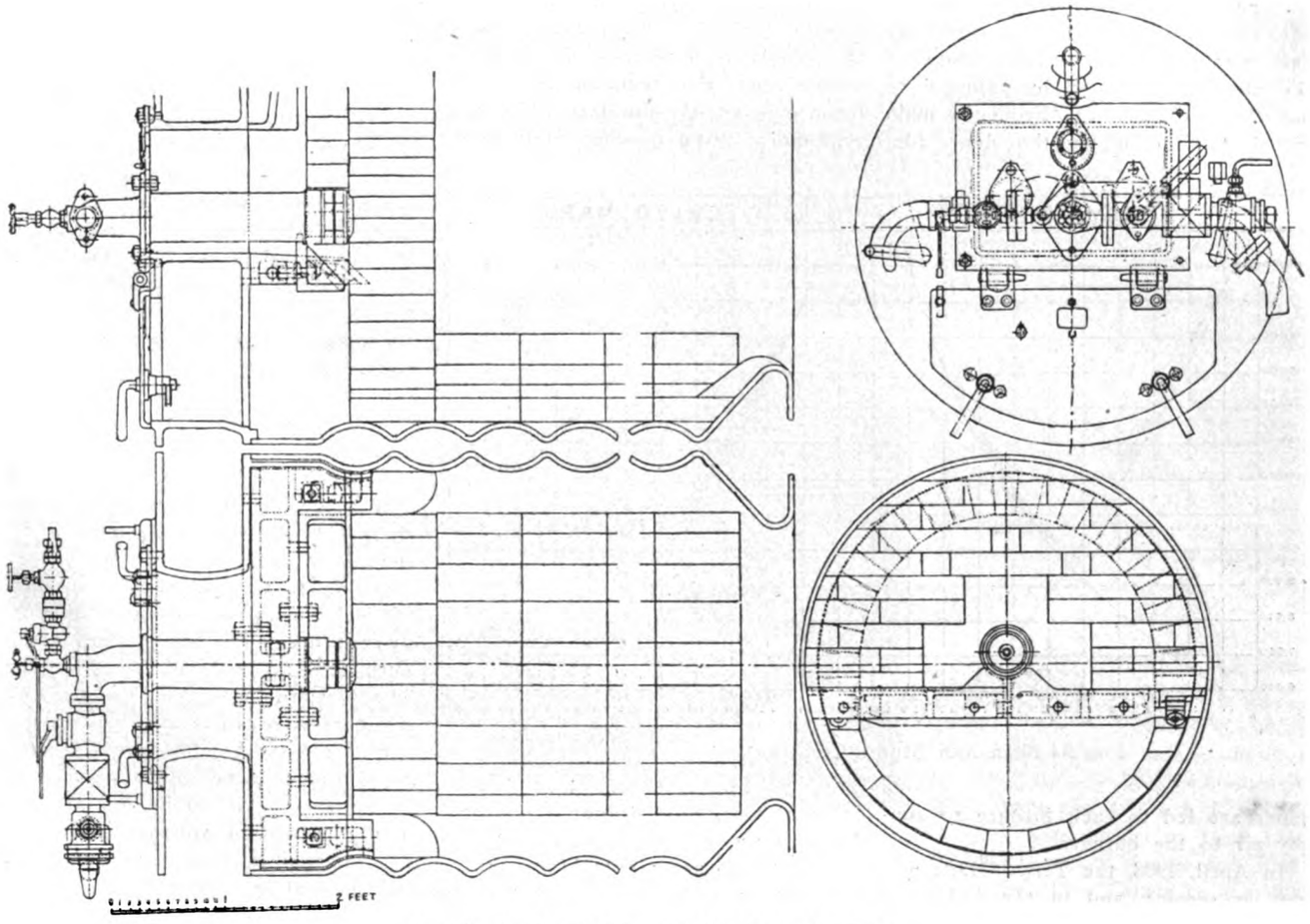

FIG. 2—ARRANGEMENTS FOR BURNING OIL FUEL.

with other systems. Mechanical spray burners are simple in construction, but cannot be worked satisfactorily with very heavy oil. Several experiments were made on shore with different kinds of spray burners, using Californian fuel oil; and it was found that the burners are only workable when the oil is highly heated, which seemed to be rather objectionable in passenger steamers. Attention was then turned to burners using compressed air, and among these the Lässoe and Lovekin's was considered suitable for heavy oil, mainly for the reason that,

There are four duplex pumps for sending fuel oil to the burners, two arranged in duplicate, in each boiler room, and each having dimensions of 4½ in. by 6 in. by 6 in. One is quite sufficient to supply oil to six boilers in full power. Each pump has the following connection:—Suction from settling tank; suction from cofferdam bilge in stokehold; delivery to burners; delivery overboard.

The suction inlets of the pumps in the settling tanks are provided with steam heating coils, to increase the fluidity of the oil. This was found

arrangement oil can be easily heated to any degree of temperature. In the ring, and remotest from the pump, a small pipe, with valve, is branched and connected to the suction of the fuel pumps. By means of this arrangement heated oil can be passed through the whole system of oil pipings over and over again before starting the fires, and thus suitably heated oil can be supplied to all the burners, and regular firing can be obtained at once.

The atomizing air for burners is supplied by eight blowers on Root's

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system. Two blowers are located in each stokehold, and have cross connections between them, forming the main air duct and reservoir. At ordinary sea speeds only half the number of blowers will suffice; the other four are kept spare. The pressure of air at the discharge of the blowers is kept at about 1½ lb. per sq. in., or 3 in. of mercurial column. Better results are always obtained by atomizing oil with heated air, and, with this end in view, the blowers are arranged to take the air from the Howden's heater provided in the uptake of each boiler. The blowers are also made to take cold air from stokehold directly by opening the flap valve provided in the suction pipe of the blower. By this arrangement the temperature of the atomizing air can be adjusted to suit the quality of oil. From the main air duct lying under the floor 2-in. pipes are led to each furnace to supply air to the burners.

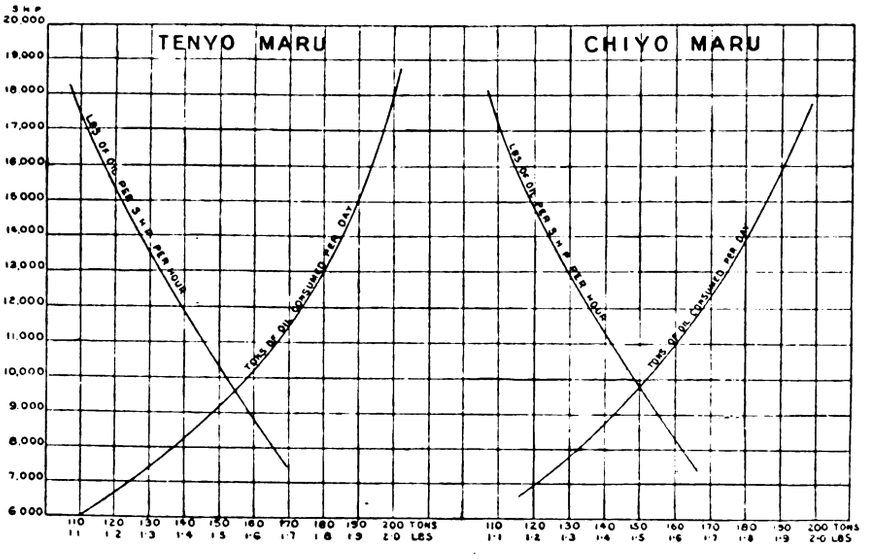

FIG. 3—FUEL AND STEAM CONSUMPTION CURVES.

In April, 1908, the Tenyo Maru was put in service, and in the following December the Chiyo Maru. Ever since on both ships experiments have been conducted, with the object of reaching the minimum consumption of fuel.

The following are the principal results for oil burning found by experience:—

(1) The degree of heating desirable for the oil depends on the quality, and, in general, the best results can be obtained by heating to a little below the flash point.

(2) With Lassoe burners, the oil pressure at the burners should not be more than a few pounds above atmospheric pressure. It will be sufficient to have the pressure at the delivery of the fuel pump just capable of passing the oil through the pipes. In the case of the Tenyo and Chiyo Maru, the pressure at the delivery of the pumps varied from 15 lbs. to 20 lbs. per sq. in. by gage. It was also found, with the burners, that better results are obtained by injecting oil into the furnace by the pressure of the atomizing air rather than by the pressure of the oil itself, as in the mechanical spray burners.

(3) The air supply to the furnace from the Howden's draught fans requires more delicate adjusting than in coal burning. When the supply of air is deficient, dense black smoke is produced, and a heap of unburned coke is soon formed in the furnace. When the supply is in excess, no smoke is visible, but the temperature in the furnace is greatly lowered. The most economical firing is when faint smoke is seen rising up through the funnel. In such a state of firing, in the case of the Tenyo and Chiyo Maru, the air pressure in furnace was found to be about ¼ in. This pressure is very low as compared to coal fires, where great resistance is encountered in passing air through the fire and grate.

(4) Impurities of the oil form the most objectionable feature in burning, and with impure oil the consumption becomes enormously increased. When oil contains salts, a very obstructive incrustation is formed in the holes of the nozzle. This being solid salt, its removal can only be effected by passing reamers through the holes. With the nozzles choked, atomizing becomes very much reduced, and consequent increase of consumption is unavoidable. Thus, when oil is used as fuel, separation from impurities is a matter of urgent necessity. The separation is most effectively done in settling tanks, and more quickly done by heating the contents by the steam coils therein provided.

Information with regard to the consumption of fuel in the ships will be of interest. The diagrams on Fig. 3 show the relation between shaft horsepowers of the turbines and consumption of fuel. The consumption of oil in the Tenyo and Chiyo Maru can be read with accuracy by the level gages provided at the front of the settling tanks.

Another curve showing the rate of consumption per S. H. P. per hour is drawn on the same plate. From this curve it can be at once observed that the rate of consumption is greatly increased at reduced powers. At 18,500 S. H. P. the consumption of oil is about 1.05 per S. H. P. per hour. This figure may be compared with the coal consumption observed on the trials made by the builders, in which case, for the same power, 1.52 lbs. of the best Takashima coal were required per S. H. P. per hour. Hence, oil consumption in proportion to coal consumption is approximately in the ratio of 2:3.

The above was prepared for the meeting of this institution, which was to have been held last year. Since then a little more experience has been gained. This may be summarized in the following note:—

Owing to the uncertainty of supply of fuel oil in Japan and China, the owners decided a short time ago to burn coal at this end of the voyage. The forward battery of boilers, six in number, were therefore converted to use coal as fuel, while the aft battery consisting of seven boilers, were still to burn oil. As 10 boilers are commonly needed in ordinary service, the coal and oil-burning boilers are used in combination to suit local conditions of fuel supply. It has been found that the consumption in the case of coal-burning is 20 to 22 tons, against 14 tons of fuel oil.

Tonnage Taxes

Tonnage taxes during the year ended June 30, 1911, amounted to $1,083,522, the largest annual collection since 1884, although the tariff act of 1909 reduced from 3 cents to 2 cents the rate of tax on vessels from nearby-foreign ports and since March, 1910, vessels in trade between the United States and the Province of Ontario have been wholly exempt by reciprocal legislation.

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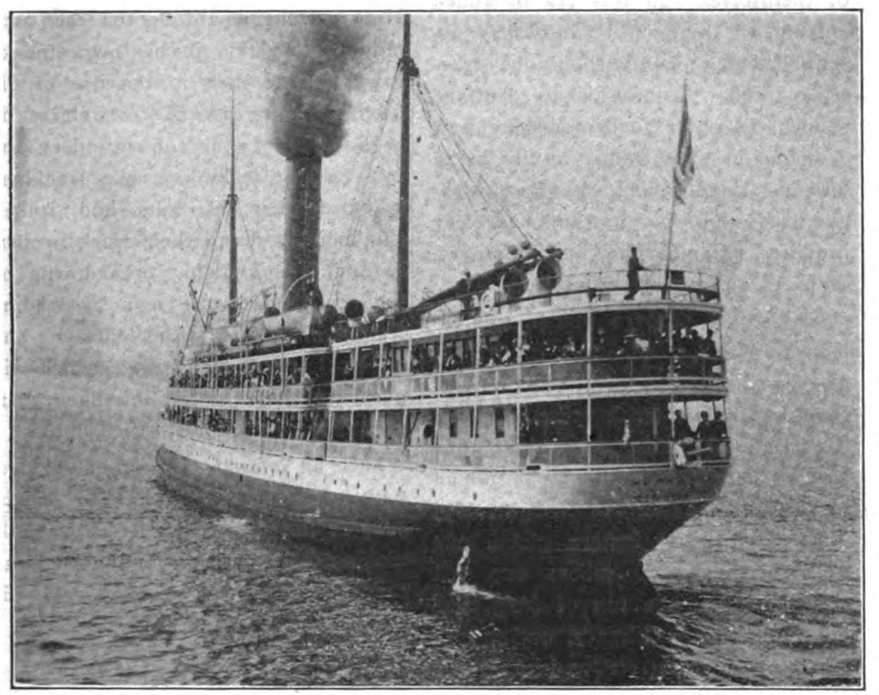
Steamer Spokane Stranded

Seattle, July 31. With a patch, 24 ft. long and 6 ft. in width over a jagged hole on her starboard side just above the tank top the excursion steamer Spokane, owned by the Pacific Coast Steamship Co., arrived here to undergo extensive repairs after having lain almost a month in Plumper Bay, B. C. The Spokane, which was built in 1902 by the Union Iron Works, San Francisco, exclusively for the excursion business in Alaska, was so badly injured in Seymour Narrows, B. C., late on the night of June 29 that it was with the most extreme difficulty that Capt. James E. Guptill succeeded in steering her into Plumper Bay, two miles away, where she was beached. The injured vessel is now in the dock of the Moran company, Seattle, undergoing survey. Bids will be invited shortly and the Spokane will be repaired here, it is expected, although she will not again be in service this season.



EXCURSION STEAMER SPOKANE, WRECKED IN SEYMOUR NARROWS, B. C.

Carrying 150 excursionists and a crew of fifty the Spokane was on her second excursion voyage of the season when she struck in Seymour Narrows about 11:15 p. m., June 29. She was northward bound and in the terrific tide rips of the narrow channel she was carried off her course and dashed against the rocky shore. Immediately she began to fill. The forward hold began to take water and she went down by the head, rendering her almost unmanageable. To illustrate her helpless condition it is but necessary to state that the vessel described a complete circle while her officers were attempting to get her into peaceful Plumper bay where she was beached.

The Spokane was insured both at Lloyd's and in the American market for approximately $200,000. A contract was signed with the British Columbia Salvage Co. which did an exceptionally clever piece of salvage work on the vessel and she returned to Seattle July 25, under her own steam and aided by the salvage tug. The cost of repairs is not yet known but it is understood that the underwriters figure on saving $40,000 of the total insurance. The salvage work was conducted under fairly favorable circumstances. Divers removed much of the baggage and patched up the ragged hole on the starboard side abreast of the foremast. The vessel was moved to a better location for making temporary repairs and would have been floated some time sooner had the tides been favorable.

Known as the millionaires' floating palace, the Spokane has a reputation over the entire world, as she has carried thousands of wealthy people to scenic Alaska. Until last season, she had good luck, but in June, 1910, she grounded in Peril Straits, Alaska, doing damage to her bottom which it cost $40,000 to repair. Her double bottom saved her from sinking and upon her return, the Moran company did record fast work in making her ready for a return to service. This season's mishap has been much more serious and costly and it will place the vessel out of service again until next year.

The Pacific Coast Steamship Co. has been peculiarly unfortunate this year. In January the steamer Cottage City was lost but a few miles from where the Spokane was lost. A few days later fire aboard the steamer Queen did considerable damage and since then the same company's steamer City of Puebla had fire aboard at Seattle. The steamer Tampico of the same fleet sank in her berth in this harbor in May and lay on the bottom for a month, entailing a repair bill of close to $40,000. The steamer Santa Rosa was lost off the California coast a few days after the Spokane mishap, so that 1911 has been an unlucky year for this big company.

Where the Spokane struck the rocks of the mainland is a narrow channel, with Vancouver island to the west. All vessels bound for Alaska have to pass through Seymour Narrows unless they go via Cape Flattery and northward by sea. That the passengers of the Spokane had a very narrow escape is conceded for if the vessel had foundered in the narrows, many lives would have been lost in the boiling, turbulent waters of the narrow passage. Shipping men agree that the Spokane was well handled.

Cruise of the Arctic

The report of the government expedition of the Dominion of Canada to the Arctic islands and Hudson strait on board the auxiliary schooner Arctic under command of Capt. J. E. Bernier has just been issued in book form by the Department of Marine and Fisheries under the title "Cruise to the Arctic." The purpose of the expedition was to increase the government's knowledge of its northern waters and annexing territory to British possessions as far west as longitude 141 degrees. The Arctic cruised in Davis strait, Baffin bay, Melville bay, Smith sound, Lancaster sound, Barrow strait, Melville sound and McClure strait. The work is richly illustrated with a great variety of photographs and is a thoroughgoing diary of the trip. It is, however, scarcely more than a diary and, owing to the absence of variety of treatment, is lacking in entertainment. An experienced writer could make a wonderfully interesting series of stories out of Capt. Bernier's experiences.

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Ferninand Ohlendorf, Galveston.
Purdy Book Store, Galveston.
Charles Deferner, Galveston.
Weber & Plum, Seattle, Wash.
Lowman & Hanford, Seattle, Wash.
Standard Book & Stationery Co., Victoria, B. C.
F. LeRay, 1306 Government st., Victoria, B. C.
Thompson Stationery Co., 325 Hastings st., Vancouver, B. C.
Central News Co., 916 Pacific av., Tacoma.
Oregon News Co., 147 Sixth av., Portland, Ore.

Saving the Pennies

The Pere Marquette Railway Co. has just issued an appeal to its workers to practice economy that should appeal to every enterprise. The greater a corporation is the more inflexible it is in the exaction of discount, and rightly so. Two per cent does not seem very much. On our unit of value it would buy only a postage stamp, but at the end of the year it may mean an extra dividend or two upon the stock. It is the little things that count in the success of every enterprise, which is merely another way of saying that if one saves the pennies the dollars will take care of themselves. In this era of added cost in all things it is absolutely essential that economy should be practiced if the business is to continue sound. In order to demonstrate how economy in little things results in an ultimate large saving, the Pere Marquette system has presented a very graphic statement to its employes. Here is an excerpt from it:

"Two cent postage stamp, equivalent to hauling one ton of freight 3½ miles; lead pencil, one ton of freight 2 miles; track spike, one ton of freight 2 miles; track bolt, one ton of freight 3½ miles; one pound of waste, one ton of freight 10½ miles; one white lantern globe, one ton of freight 20 miles; one red lantern globe, one ton of freight 75 miles; one lamp chimney, one ton of freight 10½ miles; station broom, one ton of freight 35 miles; station water pail, one ton of freight 20 miles; fuse, one ton of freight 13 miles; lantern complete, one ton of freight 100 miles."

These figures are certainly illuminating in their simplicity. It shows how important is the saving of trifles in the conduct of any business, and the larger the business is the more important these trifles become. In lean years they spell the difference between profit and loss.

The Pennsylvania system, too, is emphasizing the importance of this very thing. Take, for instance, this letter to the workers of the Schuylkill division:

"The necessity for reduction of expenses at this time is very urgent. In addition to the exercising of the strictest economy in the use of material by all employes, the working time should be watched very carefully by trainmen and enginemen in order to avoid overtime whenever possible. In fact, every employe can assist in some way in accomplishing the desired reduction in expenses. As a practical illustration, if every one of the 1,400 employes of this division would save 10 cents a day for this company, it would mean a total saving of $140 per day, in the month of April, $4,200. This would go towards paying the increased rate of wages which we are now enjoying. How easy it would be for each employe to do this in his own line of work, engine men in the use of oil, firemen in the use of coal, clerks by economy in the use of stationery and by avoiding making errors, trackmen gathering up old bolts and spikes, shopmen by doing their work properly and thus avoiding breakdowns on the road; warehouse men by loading freight so as to avoid damage, and all employes in many ways which will occur to them in the intelligent performance of their respective duties."

Such an intimate appeal should meet with sympathetic co-operation on the part of the workmen. It is virtually making them partners in the business, receiving their dividends weekly in the way of a better wage.

Licenses Must be Renewed Promptly

The department of commerce and labor in a circular letter directs attention of vessel owners to the following provision of the revised statutes:

"It shall be unlawful to employ any person, or for any person to serve as a master, chief mate, engineer or pilot of any steamer, or as master of any sailing vessel of over 700 gross tons, or of any other vessel of over 100 gross tons carrying passengers for hire, who is not licensed by the inspectors; and anyone violating this section shall be liable for a penalty of $100 for each offense."

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It is understood that violations of this character have become very frequent and that practically in every instance when appeals have been made for the remission of the penalties imposed the licensed officer has given the excuse that he did not know that his license had expired or that it had slipped his mind to renew it. Vessel owners usually offer the excuse that they had no personal knowledge of the life of the license and that when they are assured by the officer that he has a valid license, they engage him and consider that their responsibility ends.

As every license bears upon its face the term for which it is issued and gives the date of issuance, there is no excuse for not knowing when it terminates. The department has taken the stand that in the future no leniency may be expected and that no mitigation or remission of penalties will be allowed.

Taxation of Bulk Freighters

The state tax commission has latterly been giving consideration to the taxation of bulk freighters on the great lakes. Recently a committee, consisting of Harvey D. Goulder, W. W. White, Col. J. J. Sullivan, A. H. Hawgood, Capt. John Mitchell, W. H. McGean and C. L. Mosher, appeared before the commission in Columbus to assist in reaching an equitable basis for the taxation of this form of property. Mr. Goulder thought that a proper basis would be a sum not to exceed 25 per cent of the valuation fixed by Lloyds as a basis for insuring. Lloyds valuations, he explained, were estimated on the tonnage of vessels at the rate of $53.50 per gross ton, the insurance premiums being 6 per cent on that valuation. W. M. Duncan, however, who represented the Gilchrist Transportation Co., declared that if the boats of his company were taxed at more than 15 per cent of the insurance valuation the company would be practically forced out of business. Depreciation, obsolescence and changes in form of construction were advanced as the chief reasons for valuing boats below their construction cost. Mr. Goulder advanced the argument that many steamers built even as recently as five years ago could now be replaced for three-fourths and sometimes almost one-half of their original cost. Moreover, consideration should be given to the uncertainties of the trade, as vessel property represents a potential more than a real value. In brisk times it is a money maker, but in lean years, such as the present, it can scarcely pay expenses. The tax commission promised to visit Cleveland and inquire further into the subject, but so far nothing has developed.

Sailing Dates of Steamers

The department of commerce and labor has inaugurated a new service which should be of considerable assistance to manufacturers engaged in the export trade. This new service consists of issuing a bulletin monthly showing sailings from American ports to all parts of the world. It is issued well in advance of the month for which the sailings are noted and therefore allows the manufacturer ample time to arrange for shipments. The bulletin is certainly an interesting one to study, especially in relation to the trade ports of the South American continent. There is not a single American line running to any of these American ports. It is certainly a pitiable spectacle that this country, richer in resources than any other, should have to depend upon foreign steamships to carry its products to the southern part of its own hemisphere.

No American Vessels to Bid

It does not appear as though any American vessels are going to respond to the advertisement of the post office department under the postal act of March 3, 1891, for carrying the mails between New York, San Francisco and Seattle via the Panama canal. Vessels of American register of the requisite size and speed cannot compete in this service with foreign tonnage. It is estimated that the cost of operating an American ship to Colon is $18,000 a month as compared with $13,000 for the average foreign vessel. The law under which these bids are solicited provides a maximum compensation of $2 a mile outward for American built steamships of from 16 to 20 knots speed, to be constructed on designs approved by the navy department for possible future use as auxiliary cruisers. The companies that would be naturally interested in this contract, having American register, would be the Panama Railroad Steamship Co., the Pacific Mail Steamship Co., the American-Hawaiian Steamship Co., and the Pacific Coast Steamship Co., These companies have no vessels that meet requirements and would have to build. There are three routes to be covered, namely, New York to Colon, calling at Charleston or Savannah once a week; New Orleans to Colon once a week; and Seattle to Panama with the right to call at Astoria once every two weeks, also calling at San Francisco and alternately at San Pedro and San Diego.

Congress ought to take into consideration the fact that an American ship cannot operate as cheaply as a foreign ship and should have provided against this natural handicap.

Capt. Van Schaick Released

Capt. Wm. H. Van Schaick, who was sentenced to serve 10 years at Sing Sing prison, following the destruction by fire of the steamer General Slocum on June 15, 1904, in Long Island sound, wherein 1,031 lives were lost, was pardoned last month. Ever since Capt. Van Schaick was sentenced efforts to secure his pardon did not cease, there being widespread feeling that he was not as culpable as the officers and directors of the company. The testimony submitted at the inquiry indicated a lack of discipline and preparedness on board the General Slocum but her condition must have been known to the officers of the company, and Capt. Van Schaick probably felt that they were such that he could not personally remedy. He

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doubtless felt that it was up to him to operate the steamer as she was or quit his job. He may have committed an error in judgment in not beaching his boat, or attempting to do so, earlier than he did; but all men are liable to errors of judgment. The catastrophe was an appalling one, and it is too bad that so many lives should have been sacrificed to teach the steamship company the absolute necessity of observing some very simple rules. There was mighty little satisfaction in sending this old man to jail. His life had almost run the allotted span of three score years and ten when he was sentenced.

Still at It

A recent issue of the *Weekly Commercial News*, San Francisco, states that 12 foreign steamships are now on their way from Newport News and Norfolk to San Francisco, loaded with coal for the United States navy, and six additional foreign steamers are on the way from the same points to Puget sound with similar cargoes. This fleet has a combined tonnage of over 50,000 gross. There can be little wonder under these conditions that American shipping on the Pacific remains at an extremely low ebb. Unheeding the interests and the appeal of its own people, the government continues to stifle its own commerce by shipping enormous tonnages of navy coal to the Pacific in foreign steamers. There is no knowing when this practice will cease, but every day it continues the American Merchant Marine is pushed so much further to the vanishing point.

The charter list of the *Weekly Commercial News* also states that in addition to this fleet of foreign tramps, one lone American ship has also obtained a cargo of government coal to be delivered at San Francisco. This vessel is the American ship Dirigo.

We wonder how this one charter happened to be given out. The navy department very evidently made a mistake, and undoubtedly some undersecretary has been severely reprimanded for his carelessness in permitting an American ship owner to get even an infinitesimal share of this business.

In Violation of Coastwise Laws

STEAMSHIP lines on the lakes engaged in the excursion trade are very much interested in a recent ruling of the department of commerce and labor regarding the action of the Canadian steamboat Turbinia in leaving Charlotte, N. Y., on July 9 with a party of 915 excursionists for Presque Isle bay on the Canadian side and returning them to Charlotte without disembarking at Presque Isle bay, because the channel was blocked. The department promptly fined the Turbinia $183,000, being a fine of $200 for each passenger carried. This is the fine imposed upon foreign steamships that violate the coastwise laws of the United States, the department holding that by its action the Turbinia had transported passengers from one United States port to another United States port. The assessment of this prodigious fine created the utmost astonishment, as it has been the practice for some years for Canadian steamboats to call at Charlotte to take passengers across the lake to various Canadian resorts. The collector of customs with headquarters at Rochester, in whose district Charlotte is, took the subject up with the department, and upon his representation that the law has been generally misunderstood, the penalty was mitigated to $50.

It is understood that the tickets sold by the steamship company specifically provided in many instances that the passengers could not go ashore at any place until the steamer returns to Charlotte. This, of course, would be a direct violation of the coastwise laws, and it is strange that attention has not hitherto been drawn to it by some of the steamship lines on the American side. The Ontario & Ohio Navigation Co., operating the steamer Forest City between Cleveland and Canadian points, would naturally be much interested in the ruling, but as long as their passengers are actually landed on Canadian soil, their business cannot possibly be disturbed.

The department has now sent out as a circular letter the letter which it wrote to the collector of customs at Rochester for his information. It reads as follows:

Collector of Customs,
Rochester, N. Y.

Sir:—I have carefully considered the subject of transportation of passengers and of excursion parties from Charlotte by Canadian steamboats, which prompted your visit to the department on the 11th instant, when the matter was quite fully discussed.

The situation was brought to the department's attention through the case of the Canadian steamboat Turbinia, which left Charlotte on July 9, with a party of 915 excursionists for Presque Isle bay on the Canadian side and return. When the vessel with the excursion aboard arrived about half a mile from Presque Isle bay, the channel was blocked, and the vessel returned to Charlotte. The manager of the company, foreseeing this situation, had obtained two days in advance Canadian clearance papers, but this fact is not material. On Aug. 2, the department mitigated the penalty of $183,000 incurred to $500. In view of your explanation that the law upon the subject was misunderstood not only by the owners of the Turbinia, but has been misunderstood generally for years at your port and possibly at other lake ports, the penalty incurred is hereby further mitigated to $50.

From your oral statement last Friday I learn that for some years it has been the practice for Canadian steamboats to take large excursion parties at Charlotte for a trip to Presque Isle, Cobourg, Toronto, or other places on the Canadian side. The tickets sold specifically provide in many cases that the passenger shall not go ashore at any place until the steamboat returns to Charlotte. Such excursion tickets are sold daily to individual passengers when a large excursion party is not carried.

The law, which was violated in the case of the Turbinia and seems to have been generally disobeyed, is so plain that I am unable to see how it could have been misunderstood. It is inexplicable that American passenger steamboat companies in whose interest the legislation was passed have not brought it to the attention of collectors of customs.

The original law upon the subject was section 8 of the act of June 19, 1886, which read:

"That foreign vessels found transporting passengers between places or ports in the United States, when such passengers have been taken on board in the United States, shall be liable

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to a fine of two dollars for every passenger landed."

The committee of the house of representatives in its report said of this section:

"There seems to be no penalty provided for the conveyance of passengers between ports of the United States. There have been found no difficulties in this respect except with Canadian vessels on the lakes, which have been accustomed during the summer season to come to the American side and convey excursion parties. And it has been suggested by the treasury department that the penalty which is provided by this section will be sufficient to break up the practice."

The section quoted was amended by section 2 of the act of Feb. 17, 1898, to read:

"No foreign vessel shall transport passengers between ports or places in the United States, either directly or by way of a foreign port, under a penalty of two hundred dollars for each passenger so transported and landed."

Of this section the senate committee's report, quoting from the letter of the secretary of the treasury, said:

"Section 2. Section 8 of the act of June 19, 1886, imposes a penalty of only $2 on foreign vessels carrying passengers from one to another American port. This small penalty is wholly inadequate to preserve the coastwise carrying of passengers to American vessels on the long and expensive voyages from the Pacific coast of the United States to Alaska, up the Yukon, etc. The penalty is increased to $200. The penalty for the like offense imposed by the Canadian laws is $400, and I respectfully suggest that the penalty proposed by this action may be increased to that maximum. In cases where this may seem excessive the secretary of the treasury has the power to mitigate it."

The power to mitigate now rests with the secretary of commerce and labor.

In an opinion of the attorney general, dated Feb. 26, 1910, the scope and purpose of the legislation were set forth in these words:

"It is apparent from the language of the legislation and the reasons assigned for its enactment that it was intended to apply to domestic commerce, and was not intended to affect commerce between this and foreign countries. This view is in accord with an opinion prepared by Acting Attorney General Jenks and transmitted to the secretary of the treasury on Sept. 4, 1886. (18 Op. A. G., 445.) The facts there under consideration were that a number of passengers were taken on board a foreign vessel at Cleveland, O.; they there paid their fare to Windsor, Can., and after arrival at that point again paid fare to Chicago, to which port they were transported on the same vessel. It was held that, in spite of section 8 of the act of June 19, 1886, the voyage was a continuous one, and that the act applied. The transportation of the passengers between the ports of Cleveland and Chicago, via Windsor, Can., was clearly domestic commerce, and therefore fell within the terms as well as the spirit of the act."

The plain requirements of the law cannot be waived or ignored, although I realize with you that at this time of the year the disturbance of a long continued practice in violation of the statute must cause inconvenience to thousands of excursionists, who, in part, at least, may be deprived for a time of customary method of recreation. The facts as to past violations cannot now be ascertained, and you may take no action in such cases. You will, however, bring the law to the attention of transportation companies and advise them that there is no alternative to compliance. It would be well for you to bring the matter also to the attention of the public, so that it may understand and adjust itself to the situation for the rest of the season. Even now perhaps American companies may be able to supply excursion facilities.

It is not practicable for the department to give you specific instructions in advance to meet every case of violation of the law which may arise. If in doubt about any case, you will submit it to the department for a ruling. You must distinguish between domestic commerce and commerce with the Dominion of Canada. As a general proposition the passenger who departs from your district on a Canadian vessel for a Canadian port and comes back on the return trip of the same vessel has been transported in domestic commerce and the penalty of $200 accrues. When the passenger travels on a ticket which does not permit him to go ashore the violation is plain. Cases probably will seldom arise where the passenger goes ashore for a purpose to the fulfilment of which presence on Canadian soil is necessary and comes back on the return trip, but in such case the transportation would be foreign commerce and the penalty would not accrue.

A copy of this letter will be sent to collectors of customs at other ports on the great lakes.

Respectfully,
BENJ. S. CABLE,
Acting Secretary.

Aug. 14, 1911.

The Central Coal Co.'s dock at Milwaukee established a new unloading record in unloading 12,100 tons of soft coal from the steamer Willis L. King in 22 hrs.

Visits New Ship Yard at Port Arthur

President James C. Wallace and W. L. Brown, chairman of the board of directors of the American Ship Building Co., spent a week or more at Port Arthur in August examining the new plant which has been established there by the Western Dry Dock & Ship Building Co. as a subsidiary of the American Ship Building Co. The plant is rapidly assuming form, about $1,000,000 having already been expended upon it. The new dry dock, if not the finest, is certainly the most substantial on the lakes. It is hewn out of solid rock and shaped with cement. It is 700 ft. long, 94 ft. wide at top, 84 ft. at bottom, with 72 ft. gate, having 16 ft. of water over the sill and 16 ft. 6 in. over blocks. The boiler shop, machine shop, and mold loft are rapidly taking shape and the company still expects to spend about $500,000 in further development of the yard. About 500 men have been steadily employed throughout the year in getting the plant into shape. Mr. Lindsey Wallace is manager of the yard and Hugo L. Tims, formerly in the Chicago yard, is the superintendent.

Genoa-Gilbert Collision

The wooden steamer City of Genoa of the Gilchrist Transportation Co.'s fleet was sunk in collision with the steamer W. H. Gilbert of the Pittsburgh Steamship Co.'s fleet off Sarnia in a dense fog about four o'clock on the morning of Aug. 26. The City of Genoa, which was bound down with grain, was at anchor when the collision occurred. The Gilbert, downbound with ore, struck her abreast of the pilot house and she sank in 33 ft. of water in about four minutes, the crew escaping to the Gilbert meanwhile. It appears that the Genoa had just dropped her anchor when the Gilbert showed up in the fog and apparently nothing could be done to avoid the accident. Contract was given to James Reid and Harris Baker, wreckers, jointly, to raise her on the "no cure no pay" plan. The Genoa is quite badly injured and as there is a very stiff current at this point there may be some difficulty in getting her. The Genoa was built by Capt. James Davidson of Bay City in 1892 and was 301 ft. keel, 42½ ft. beam and 20 ft. deep. She was not insured. The Gilbert sustained a crushed bow and went to the yard of the Toledo Ship Building Co. for repairs.

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Ore Unloading Record

The steamer Thomas Lynch of the Pittsburgh Steamship Co.'s fleet, was unloaded in record time at the Superior dock, Ashtabula, on Aug. 10 by the four 15-ton Hulett electric machines. In the brief space of four hours and six minutes 10,234 gross tons of ore were taken out by them. The average tons per hour per machine were 637.6 and the average tons per hour from start to finish for the four machines was 2,550.5 tons. Unloading began at 6:30 a. m. and was finished at 10:36 a. m. Following is the detailed data per machine:

	Hrs.	Min.
Total time, start to finish, No. 1 machine	4	2
Total time, start to finish, No. 2 machine	3	52
Total time, start to finish, No. 3 machine	4	6
Total time, start to finish, No. 4 machine	4	3
Total time, start to finish, four machines	16	3
Average tons per hour, start to finish, No. 1 machine		629.7
Average tons per hour, start to finish, No. 2 machine		617.6
Average tons per hour, start to finish, No. 3 machine		697.3
Average tons per hour, start to finish, No. 4 machine		605.7
Average tons per hour, start to finish, four machines		2,550.5
Average tons per hour, per machine...		637.6

Commonwealth Steamship Co. Sells Two Steamers

Interests associated with the Inland Steel Co., of Chicago, have purchased the steamers Arthur H. Hawgood and W. R. Woodford from the Commonwealth Steamship Co., and have organized the Inland Steamship Co. to operate them. They will be managed by Hutchinson & Co., of Cleveland. Negotiations for the purchase of these vessels have been in progress during the past three months and the deal was definitely concluded by the survey of the steamers on behalf of the purchasers by Babcock & Penton, naval architects and engineers. The price was not given out, but considering the state of the market, was doubtless low. Both steamers are representative of the modern type of bulk freighter and are in excellent condition. The Hawgood was built in 1907, and is 569 ft. over all, 549 ft. keel, 56 ft. beam and 31 ft. deep. The Woodford, which was built in 1908, is 552 ft. over all, 532 ft. keel, 56 ft. beam and 31 ft. deep.

The Schuette Recording Compass Co., Manitowoc, Wis., has established a new agency with Takato & Co., Tokio, Japan.

Iron Ore Shipments

Ore shipments during August were 5,548,311 tons as against 6,964,381 tons for the corresponding month last year, a decrease of 1,416,070 tons. The movement to Sept. 1, 1911, was 19,606,068 tons, as against 28,827,029 tons for the corresponding period last year, a decrease of 9,220,961 tons. The August movement of the present year exhibits a slight gain over July of the present year, when 5,221,373 tons were moved, an increase of 326,938 tons. August will undoubtedly be the record month of the present year.

The fleet last year moved 6,273,832 tons in September, 4,877,441 tons in October and 2,641,886 tons in November, which marked the close of the iron ore season on the lakes. Were the fleet to move this year an equivalent amount during the remainder of the season, the total shipments for the year would be 33,399,227 tons. The fleet of course will not move anything like that amount during the remaining months of the year. It is doubtful if the September movement will reach 5,000,000 tons, as heavy weather may be expected at any time during the month and, moreover, ore sales have not been such as to justify a heavy movement under adverse weather conditions; and as shippers expect to be through with outside ships in October, the October and November movements will be light. It is likely that the movement for the entire season will not be much in excess of 31,000,000 tons.

Following are the shipments by ports:

Port.	August, 1910.	August, 1911.
Escanaba	697,412	706,445
Marquette	525,898	357,571
Ashland	645,107	407,578
Superior	1,332,284	1,689,952
Duluth	2,382,156	1,211,667
Two Harbors	1,381,524	1,175,098
	6,964,381	5,548,311
1911 decrease		1,416,070

Port.	To Sept. 1, 1910.	To Sept. 1, 1911.
Escanaba	3,162,271	2,418,251
Marquette	2,249,774	1,200,748
Ashland	2,878,971	1,509,841
Superior	5,227,687	6,382,273
Duluth	9,823,644	4,370,117
Two Harbors	5,484,682	3,724,838
	28,827,029	19,606,068
1911 decrease		9,220,961

Floating Dry Dock at Toronto

The Dominion government has approved plans for a floating dry dock to be built at Toronto by the Polson Iron Works under a guarantee of 3 per cent per annum for 20 years upon a capital expenditure of $900,000. The dock will be built in three sections, each 200 ft. long and 100 ft. wide. It is expected that two of the sections will be completed early in 1912 so that vessels can be docked in the spring. When completed the dock is expected to lift 9,000 tons and that will be ample to accommodate any vessel that is likely to visit Lake Ontario. The dock will be electrically operated. New shear legs capable of lifting 100 tons will be installed in conjunction with the dock.

Commerce of Lake Superior

The commerce of Lake Superior as measured by the canals at Sault Ste. Marie reached 8,548,812 tons during August, being 2,993 tons in excess of the July movement, when 8,545,819 tons were moved. The movement to Sept. 1 was 31,488,323 tons as against 40,046,800 tons for the corresponding period last year. The falling off of course is in the ore movement, coal showing a respectable gain over the figures for 1910. Following is the summary:

EAST BOUND.

	To Sept. 1, 1910.	To Sept. 1, 1911.
Copper, net tons	77,070	71,078
Grain, other than wheat, bu.	22,068,070	78,418,257
Building stone, net tons.	6,990	4,137
Flour, bbls.	3,791,428	3,454,630
Iron ore, net tons	28,055,531	18,683,240
Pig iron, net tons	19,331	17,784
Lumber, M. ft., B. M...	374,379	328,327
Wheat, bu.	32,695,234	34,078,649
Unclassified freight, net tons	87,357	79,453
Passengers, number	23,594	30,276

WEST BOUND.

Coal, anthracite, net tons.	1,060,259	1,226,515
Coal, bituminous, net tons.	7,297,788	8,116,034
Flour, bbls.	1,100	125
Grain, bu.	2,100	1,100
Manufactured iron, net tons	247,327	242,990
Iron ore, net tons		12,622
Salt, bbls.	397,367	382,826
Unclassified freight, net tons	724,787	732,632
Passengers, number	27,567	35,130

SUMMARY OF TOTAL MOVEMENT.

East bound, net tons	30,657,557	21,100,586
West bound, net tons	9,389,243	10,387,737
	40,046,800	31,488,323

The total number of passages to Sept. 1, 1911, was 11,174, and the net registered tonnage, 24,787,488.

Lake Erie Ore Receipts

Out of a total movement of 5,548,311 tons of iron ore in August, 4,368,210 tons came to Lake Erie ports, distributed as follows:

Buffalo	473,525
Erie	28,004
Conneaut	1,232,993
Ashtabula	1,065,421
Fairport	130,008
Cleveland	702,285
Lorain	555,593
Huron	61,173
Sandusky	
Toledo	85,218
Detroit	33,990
	4,368,210

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Car Ferry Chief Wawatam Launched

The Toledo Ship Building Co., Toledo, launched on Aug. 26, the car ferry Chief Wawatam, for the Mackinac Transportation Co. The new car ferry is 352 ft. over all, 323 ft. 6 in. between perpendiculars, 62 ft. beam and 25 ft. molded depth. She has triple screws, one forward and two aft. Her machinery consists of three triple-expansion engines with cylinders 21, 33 and 52 in. diameters by 40 in. stroke, supplied with steam from six boilers, 13 ft. 6 in. diameter and 12 ft. long, fitted with forced draft and allowed 185 lb. pressure. She has four tracks and will carry 26 cars. As will be noted from the illustrations, she loads from the bow. The ship yard had her boilers and two engines aboard on Sept. 1 and will undoubtedly have her ready for delivery on Oct. 15, as per contract.

LAUNCHING CAR FERRY, CHIEF WAWATAM.

August Lake Levels

The United States Lake Survey reports the stages of the Great Lakes for the month of August, 1911, as follows:

Lakes	Feet above tidewater, New York.
Superior	602.15
Michigan-Huron	579.83
Erie	571.62
Ontario	245.19

Lake Superior is 0.51 ft. higher than last month, 0.18 ft. higher than a year ago, 0.71 ft. below the average stage of August of the last 10 years, 1.78 ft. below the high stage of August, 1876, and 0.55 ft. above the low stage of August, 1879. It will probably rise 0.1 ft. during September.

Lakes Michigan-Huron are 0.05 ft. lower than last month, 0.49 ft. lower than a year ago, 1.33 ft. below the average stage of August of the last 10 years, 3.68 ft. below the high stage of August, 1876, and 0.05 ft. below the low stage of August, 1896. They will probably fall 0.2 ft. during September.

Lake Erie is 0.13 ft. lower than last month, 0.60 ft. lower than a year ago, 1.08 ft. below the average stage of August of the last 10 years, 2.49 ft. below the high stage of August, 1876, and 0.24 ft. above the low stage of August, 1895. It will probably fall 0.3 ft. during September.

Lake Ontario is 0.35 ft. lower than last month, 0.86 ft. lower than a year ago, 1.45 ft. lower than the average stage of August of the last 10 years, 3.07 ft. below the high stage of August, 1862, and 0.84 ft. above the low stage of August, 1895. It will probably fall 0.4 ft. during September.

Steamers for South America

James Rees & Sons Co., Pittsburgh, Pa., has recently taken contract for 14 stern wheel steamboats for South America to be 125 ft. long from stem to main transom and 3 ft. 6 in. depth of hold, with a sheer of 3½ ft. The hull is to be of galvanized steel plate and with three longitudinal bulkheads secured to bottom plates and floor angles with flanged intercostals. The steamers are to be equipped with the regular western river style of high pressure, lever poppet valve type of engine, cylinders 9½ in. diameter and 4 ft. stroke, supplied with steam from locomotive boiler, having 850 sq. ft. of heating surface and about 200 lbs. pressure. The steamers are intended to make 10 miles an hour in dead water, and when fully loaded will carry 200 tons of freight.

Torpedo Boat Destroyers Awarded by Navy

Acting Secretary of the Navy Winthrop has awarded contracts to the following-named companies for the construction of the eight torpedo boat destroyers authorized by the act of March 4, 1911, as follows:

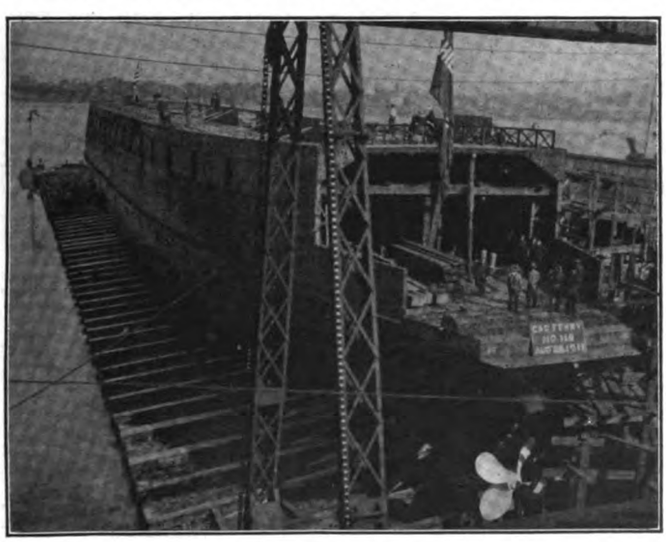
Four boats: William Cramp & Sons Ship & Engine Building Co., Philadelphia, $756,000 each.

Two boats: Bath Iron Works, Bath, Me., $761,500 each.

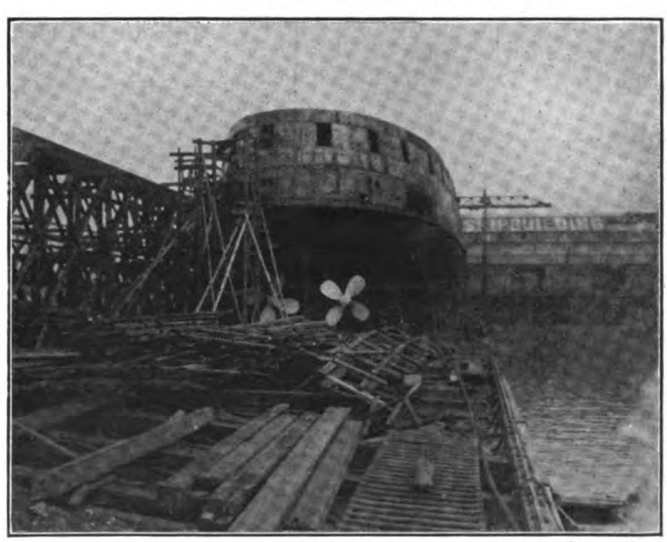
One boat: New York Ship Building Co., Camden, N. J., $777,500.

One boat: Fore River Ship Building Co., Quincy, Mass., $779,450.

All boats to be finished and delivered in 24 months from date of contract.



BOW VIEW OF CAR FERRY CHIEF WAWATAM ON THE STOCKS.



STERN VIEW OF CAR FERRY CHIEF WAWATAM ON THE STOCKS.

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Obituary

Thomas T. Morford, who had spent a long and honorable life on the lakes, died at his home in Buffalo on Monday, Aug. 28. He had been associated with lake trade since boyhood. He was born near Middletown, N. J., Sept. 2, 1838. As a young man he went to Chicago and entered the employ of the Erie railroad in the Union Steamboat line's office there. For a number of years he was agent of the steamboat line at Chicago. He served the Erie railroad in many capacities for more than 40 years, going in 1901 to Buffalo as

THOMAS T. MORFORD

the manager of the Union Steamboat line. Four or five years ago his health began to fail and he relinquished the management, taking the position of general agent.

He was for many years an active force in the affairs of the Lake Carriers' Association and was a member of the board of directors and executive committee of that body at the time of his death. He is survived by a widow and six children, James B. and W. G. Morford, of Chicago; T. E., Arthur and Rex H. Morford, of New York, and Annis D. Morford, of Buffalo.

Omar N. Steele, Cleveland, manager of the American Ship Building Co.'s plants, died at his home in Lakewood on Aug. 17, as the result of a stroke of apoplexy which he had received two weeks earlier. It is quite safe to say that no man on the whole chain of lakes was more respected than Mr. Steele. While but little acquainted with theory he had a very large fund of practical information along engineering lines and was a most competent mechanic. He developed with the business and took an active part in it almost up to the time of his death. His chief charm was his personality and by his very nature never failed to smooth out the little annoyances that constantly arise in the management of plants.

He was born in Amherst, O., in 1843. When the civil war broke out he served in the 181st Ohio volunteer infantry. At the close of the war he became an engineer on the great lakes, bringing out in 1882 the steamer Onoko, which was the first iron bulk freighter to be built on the lakes. Shortly thereafter he became associated with Robert Wallace in the Cleveland Ship Building Co., which later was merged into the American Ship Building Co. Mr. Steele took very deeply to heart the death of Mr. Wallace, which occurred a few months ago in Florida. Mr. Steele is survived by his wife and two daughters, Mrs. H. H. Hodge, of North Dover, O., and Mrs. F. J. Weideman, of Cleveland.

Around the Great Lakes

The grain cargo of the sunken steamer City of Genoa was sold to a Port Huron distiller for $13,555.

The Breakwater Co., Hickox building, Cleveland, was the successful bidder for the construction of four dykes in the Delaware river, below Philadelphia, at an aggregate cost of $1,200,000.

Capt. Thomas H. Sanders will bring out the new steamer Col. John M. Schoonmaker for the Shenango Steamship & Transportation Co. The new steamer is expected to go into commission about Oct 1.

The after section of the steamer W. C. Moreland, 250 ft. long, including eleven hatches, was towed into the basin inside the upper Portage canal breakwater on Sept. 1 by the tugs Manistique and Cora A. Sheldon. Capt. James Reid says that he will make an attempt to get the other two sections of the Moreland this fall.

Thomas L. Durocher, Sault Ste. Marie, Mich., was the lowest bidder for the construction of a rubble mound breakwater at Dibble Point, Mackinac Island. His bid was $1.14½ per ton. The other bidders were Great Lakes Dredge & Dock Co., Chicago, $1.15 a ton; Green Stone & Quarrying Co., Sawyer, Wis., $1.60; Inland Waterways Co., Ashtabula, $1.62.

The names of the package freight steamers Alva and W. H. Gratwick, of the Chicago & Duluth Transportation Co.'s fleet, have been changed. The Alva will hereafter be known as the Minnetonka and the Gratwick as the Minnekohta. The Alva was formerly owned by M. A. Bradley, of Cleveland. Capt. John Mitchell, of Cleveland, built the Gratwick, but subsequently sold her to the United States Transportation Co.

The steamer Melrose, bound for Montreal, cleared from Sandusky on Aug. 28 with a cargo of wheat. This revives memories of the time when Sandusky was a wheat shipping port. A wagon road led to Milan, which was used largely for carrying wheat from Milan. It was sent to Sandusky for shipment by water. The Melrose's cargo, however, is the first cargo of wheat that has left Sandusky in 25 years, the business being handled now exclusively by rail.

The steam yacht Gunilda was wrecked off Copper island, Lake Superior, on Aug. 31. The yacht was owned by Wm. L. Harkness, of Cleveland, who was aboard with his family and a few guests She ran on submerged rocks while apparently cruising in deep water. The passengers were all on deck when the yacht was struck and remained aboard while relief was being summoned. The wrecking tug James Whalen found little difficulty in releasing the yacht, but the moment that it was free from the ledge it began to fill and sank in 300 ft. of water. The Gunilda was built by Ramage & Ferguson, Ltd., Leith, Scotland, in 1897, and was 195 ft. over all, 166 ft. 6 in. on the water line, and 24 ft. 7 in. extreme breadth.

The tug C. C. Martin, of Midland, Ont., with her tow, the Albatross, was lost in a storm which raged on Georgian Bay on the night of Aug. 24. The Martin's crew, consisting of nine men and one woman, were drowned. The lines parted in the heavy seas and when it was seen that the Albatross was likely to founder the yawl was launched, the crew reaching shore safely after a day's buffeting. Nothing was seen afterwards of the Martin and her crew or the Albatross, though some wreckage of the Martin was subsequently found. The Martin was 71 ft. long and was owned by Mrs. Mary Martin, of Midland. The Albatross was owned by the Midland Towing & Wrecking Co., of Midland, Ont.

The Great Lakes Engineering Works is making excellent progress upon the four steamers which it is building for the Harper Transportation Co. of Boston. The names of these steamers are the Penobscot, Seaconnet, F. J. Lisman and M. E. Harper. This company has also purchased the seven whaleback barges which the Great Lakes Engineering Works took over from the Pittsburg Steamship Co. As these barges are somewhat in excess of Canadian canal dimensions they are being remodeled, 24 ft. being cut off each amidships. They are also undergoing general changes to fit them for salt wa-

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ter conditions. These barges will hereafter be known as the Providence, Portsmouth, Bangor, Boston, Salem, Lynn, and Searsport. The Great Lakes Engineering Works also has contracts for three steamers for service between Atlantic coast ports and Porto Rico. Two of them are to be delivered in the fall and the third one in the spring. The steamer Portland is also being remodeled for this company. It is understood that President Pessano has also closed contract for a steamer for service on the Pacific coast.

The McNab Company

The McNab Indicator Co., of Bridgeport, Conn., will be reorganized as The McNab Co. Alex. McNab recently returned from England and has decided to extend the activities of the company to embrace certain specialties. He has secured the American rights for the Porhydrometer and the Willett-Bruce electric whistle control.

The porhydrometer is a device invented by an Italian engineer, Signor Emilio de Lorenzi, for weighing the cargo of a vessel. The instrument is based upon the principle that the vessel displaces its own weight in water and by its application the vessel is transformed into a weighing machine. In the center of the vessel a vertical tube is fitted extending from well below the light draught line to well above the load line and connected by a pipe with the outside shell of the vessel, so that when the valve or cock is open the water in which the vessel is floating has free access to the vertical tube and rises in it to exactly the same level as outside the vessel. Inside the vertical tube is fitted a vertical float called the aerometer, which, having exactly proportionate horizontal areas at the various immersions to the areas of the planes of flotation at the present draught of immersion of the vessel, has an exactly similar displacement and reduces the enormous weights dealt with to a measurable quantity. The aerometer being immersed to the same extent as the vessel itself by its consequent exactly proportionate displacement, loses an amount of water exactly equal to its displacement. This loss of water disturbs the balance of levers and is exactly registered or counterbalanced by moving the weights along the steel yard, giving a correct reading of the weights placed on board the vessel and, vice versa, weights removed. Experiments have shown the instrument to be quite reliable. The first vessel to be equipped was the coal carrier Procida, owned by the Navigazione Generale Italiana. A load of five tons was put into the vessel and correctly noted by the aerometer. After 1,000 tons had been put aboard a truck containing exactly five tons was added and the aerometer instantly registered the same immersion as it did for the first five tons. Mr. McNab believes that the device would be extremely valuable on bulk freighters carrying grain and would serve to eliminate payment for shortages in grain cargoes which is one of the annoying features of the trade.

The Willett-Bruce electric whistle control is the invention of W. J. Willett-Bruce, superintendent of the White Star Line. This system has been installed on the Olympic of the White Star Line, and is being extended to the other steamers of the fleet. The whistles are electrically operated, the officer on the bridge having merely to close the switch to give a blast, and there is in addition an electric time-control arrangement whereby the whistles are automatically blown at stated intervals during thick weather. The advantages of such an arrangement in fog are obvious.

Mr. McNab's chief invention is his indicator, a simple little device which tells the captain in the pilot house infallibly whether the engine is going ahead or astern.

Collier Jupiter's Propelling Machinery

The navy department has awarded contract to the General Electric Co., Schenectady, N. Y., for furnishing and installing electric propelling machinery on the new collier Jupiter to be built at the Mare Island navy yard. The plant will consist of one turbine-driven generating unit to operate at a maximum speed of about 2,000 revolutions per minute. The turbine will be of the Curtis type and will drive a bipolar alternating generator so that it will deliver current at a pressure of 2,200 volts. Each of the twin screws of the ship will be operated by a 36-pole reduction motor connected directly to the shaft. The greatest care will be taken in the installation of water-cooled resistance, which will be of such design as to absorb the entire output of the generating apparatus, if necessary. The speed reduction between the generator and the motors will be in the ratio of 18 to 1, the number of poles in the generator being two and the number of poles in the motor being 36. Spare parts for all conceivable breakdowns will be furnished and every provision will be made for quick and thorough overhauling. The efficiency of transmission of power from the turbine shaft to the propeller shaft will be approximately 91 per cent at full speed, which compares very favorably with any other type of marine propulsion. The results of the trial of this ship will undoubtedly be watched with great interest by engineers everywhere.

Robb-Brady Scotch Boilers

The Robb-Brady Scotch boiler is a modification of the well-known standard Scotch marine boiler. Although the word "Scotch" would indicate marine service, yet the boiler can be applied equally well to stationary plants. It differs essentially from the Scotch marine type in that the water and steam space, usually all in one shell, is divided into two separate chambers. The upper drum forms the steam space while the lower shell above the two furnaces is entirely filled with tubes.

As will be noted from the accompanying illustration, the combustion chamber is cylindrical and of a diameter nearly equal to that of the larger shell. Because of the cylindrical shape and the absence of the usual flat top, there is no need of girder or crown barstays, only short screwed stays being used. Again, the usual longitudinal or through stay rods are not required in the large shell because it is entirely filled with tubes. The small diameters of the two shells and the simplicity of staying greatly lessens the cost of construction.

Positive and rapid circulation is obtained by compelling the hot water from the steam drum to flow down the front neck and around the shell through the annular space provided for this purpose. The water from this annular space empties below the furnaces and replaces the hot water and steam which take the shortest path to the top passing to the steam drum through the rear neck. The very rapid circulation increases the economy of the boiler by keeping all the heating surfaces clean and in proper condition to transmit the heat freely. The rapid circulation also overcomes the great disadvantage of Scotch marine boilers. It results in uniformity of expansion and eliminates the necessity of providing a special pump or other attachment to increase circulation. This new type of boiler, which is built in units from 50 to 300 H. P. and for working pressure up to 225 lb., is internally fired. No brick setting is necessary and the hot gases are completely

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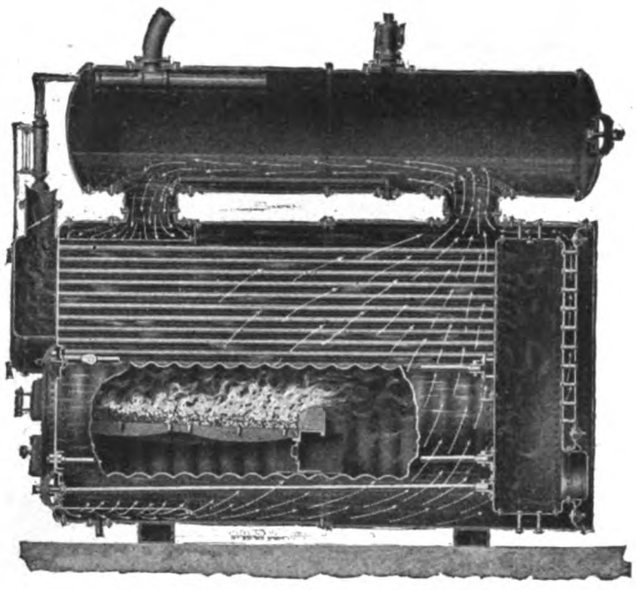


ROBB-BRADY SCOTCH BOILER

surrounded by water-heating surface from the time they leave the grates until they are discharged into the smoke flue. All radiation losses and losses due to infiltration of air through the setting are avoided.

The Robb-Brady Scotch boiler is built for both marine and stationary use and complies in all respects with the requirements of the Massachusetts board of boiler rules.

Steamer Nisqually

Seattle, July 31.—One of the smartest little passenger steamers ever built on Puget Sound is now in service on the route between Tacoma and Olympia. The Nisqually has been a big surprise to both owners and builders as she has developed considerably more speed than expected. Thus far she has not had a real opportunity to show just what she is capable of but her owners, the Olympia & Tacoma Navigation Co., believe that in time she will develop more speed than some of the acknowledged flyers of these waters.

On her first run the Nisqually steamed from the Standard Oil wharf at Seattle to the Northern Pacific wharf, Tacoma, in exactly 1 hour, 34 minutes, a distance of 29 miles. The distance between Tacoma and Olympia is approximately 40 miles and the Nisqually has been steaming over this route at an average rate of 20 miles an hour. Her best time between these two ports is 1 hour, 56 minutes, while her longest run was 2 hours, 5 minutes. This was made against the strongest tide which on the upper waters of Puget Sound runs with great force. Thus far the Nisqually has never been run within 75 lbs. of the maximum steam allowed and were her full power brought into service her owners believe that she would show her heels to any other vessel on Puget Sound.

The Nisqually was built at the yards of John Martinolich, Dockton, Wash., and was engined by the Phoenix Engineering Co., of Tacoma. She has two Taylor water tube boilers, each with 1,800 sq. ft. of heating surface. Her engines are triple-expansion, 12-in., 20-in. and 32-in. by 20-in. stroke. The steamer is 140 ft. long, 22.6 ft. beam and 7.6 ft. molded depth. She has a license for 450 passengers. The vessel is an oil burner, being equipped throughout with the Witte system of oil burners and pumps. Thus far she has proved an economical vessel, using but two and a half barrels of oil at a speed of 20 miles an hour.

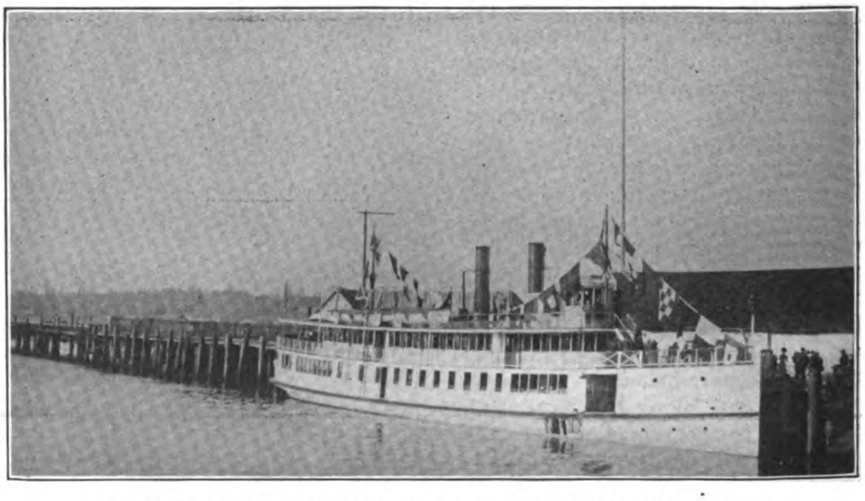
Pittsburgh Steamboat Centennial

Historians from nearly all of the colleges and historical associations of the central states and middle east will attend and deliver addresses at the Pittsburgh Steamboat Centennial, to be held at Pittsburgh Oct. 29 to 31. Among those who will attend are, Prof. A. B. Hulbert, Marietta, O., president of the Ohio Valley Historical association; Prof. Henry W. Albord, University of Illinois; Prof. Henry W. Temple, of Washington and Jefferson college; Prof. George A. M. Dyess, of the University of Pittsburgh; E. O. Randall, of the Ohio State university; Prof. George C. Lay, of New York; Albert Bettinger, of Cincinnati; President Edward E. Sparks, of Pennsylvania State college; Prof. Homer B. Hulbert, of Korea; Dr. Reuben Gold Thwaits, secretary of Wisconsin Historical society; Clarence S. Brigham, Worcester, Mass.; Prof. James A. James, of the Northwestern university, of Chicago; R. T. Wiley, of Elizabeth, and Miss H. Dora Stecker, of Cincinnati. President Taft will attend the celebration and deliver an address Oct. 31.

Coil of Rope

The accompanying picture is a coil of rope made recently by the Columbian Rope Co., of Auburn, N. Y. The coil stands 8 ft. high, and it is 8 ft. across. It contains 1,200 ft. of continuous rope. In the coil are 32 bales of the very best Manila hemp. It is made in three strands of 510 threads each.

The great weight of this coil, and its exceedingly large size, made it necessary to charter a special automobile



NEW PASSENGER STEAMER NISQUALLY, FOR TACOMA-OLYMPIC ROUTE.

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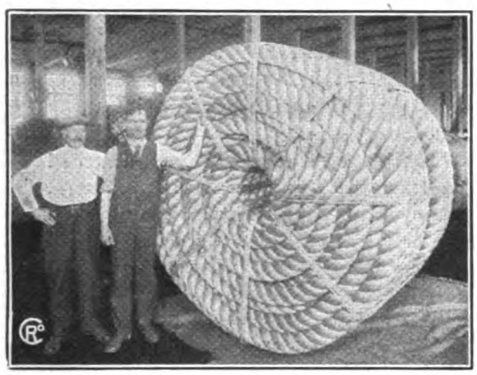

GREAT COIL OF ROPE

freight car in order to ship it. It is very seldom a coil of this size is ever made, and there are but few concerns outside of the Columbian Rope Co. that could handle a coil so large as this.

Pacific Coast Notes

The San Francisco & Portland Steamship Co. will build two new passenger and freight steamers to run between Los Angeles, San Francisco and Portland.

The Union Oil Co., of California, has leased a new steamer which is being constructed at Tyne, England, to ply on the Pacific coast between Port Harford and Chile, Panama, and British Columbia ports. The steamer will have a tank capacity of 9,300 tons.

The Monticello Steamship Co., of Vallejo, Cal., which is operating two fast steamers between Vallejo and San Francisco, has decided to begin at an early date the construction of a fast freight vessel. The proposed new boat will be of exceedingly light draught in order that it may ply up the Napa river as far as the city of Napa.

At a meeting held recently by the board of directors of the United Properties Companies in Oakland, Cal., plans were agreed upon whereby the company will organize and conduct a steamship line between the Pacific coast and the Orient and coast ports of North and South America. The officials of the company expect to have their lines in operation by the time the Panama canal is opened.

Plans are being made for new lines and more steamers plying between San Francisco, Pacific coast ports generally and the Port of Bristol, Wales. E. Manning Lewis, chief freight agent for the Port of Bristol, who is at present in San Francisco, is considering the acquisition of important docking facilities on the Pacific coast in view of the expected development of trade following the opening of the Panama canal.

Considerable dissatisfaction has been expressed at the navy yards at Mare Island, California, on account of the contracts for the construction of engines for the new collier Jupiter being given to an Eastern company. The engines represent an expense of $300,000, which will be lost to California mechanics, and will lessen the number of workmen that were expected to be employd in building the boat. The engines proposed are to be propelled by electricity and are an experiment by the navy department.

The cost of floating the steamer Spokane and putting her in first class condition will amount to more than $100,000 is the statement of those closely in touch with the situation. The repairs of the vessel will amount to $75,000, making the second largest contract of that nature ever let on the Pacific coast. According to representatives of the Pacific Coast Steamship Co., the salvage of the Spokane was one of the finest pieces of that sort of work ever undertaken on this coast. In less than 20 days after she sank in Plumper Bay the Spokane was afloat and under her own steam made her way back to Seattle, Wash.

President Alexander, of the Alaska Pacific Steamship Co., telegraphed from New York to the San Francisco office of the company, stating that he had just purchased the steamer Admiral Farragut in New York, and that the vessel will be sent to San Francisco through the Straits of Magellan in the near future. The Admiral Farragut is a sister ship of the Admiral Sampson, now operating on the coast, and the Admiral Schley, which is still in eastern waters. The trade between San Francisco and the northern ports has increased in the past few months to such an extent that the Alaska Pacific officials were obliged to add another boat to their fleet in order to handle the business.

Plans for a system of docks to be constructed on the Oakland side of San Francisco bay and to cost $15,000,000 have been completed by the United Properties company, and the work of building will begin at once. The new docks will accommodate the largest steamers afloat by the time the Panama canal is opened. The Key route, one of the properties of the United companies, will have a mole a mile and one half long and 1,000 ft. wide, on which trans-continental freight can be trans-shipped and stored in warehouses to be built along the mole at the edge of the deep water. W. R. Alberger, vice president of the company, said recently: "Plans for the big dock system are nearly completed. The engineers have been working on them for some time, and we have already made arrangements for direct connection with the Santa Fe, the Southern Pacific and through the Southern Pacific we will have connections with the Western Pacific. The docks will be of the most modern type, and warehouses will be built on the fill to accommodate the business as it expands. On the north side of the fill there will be a concrete wall, with the docks to the south. The trackage on the pier will be increased so that we can handle trans-continental freight from the holds of the vessels direct to the freight trains. Work will be begun very soon, and I can say that this is only a part of the great scheme of the United Properties Co. in the handling of freight. The docks alone will cost $15,000,000."

Trade Notes

The Santo vacuum cleaner, manufactured by Elisha Webb & Son Co., Philadelphia, is meeting with success on shipboard.

The Niles-Bement-Pond Co., 111 Broadway, New York, has just issued a catalog descriptive of their engine and gun lathes. It is, as is customary with the catalogs of this house, a very sumptuous affair. Many improvements have been incorporated in the lathes illustrated in the catalog.

"Hydraulic Pumps, Catalog No. 81" is the title of a new 120-page 6 x 9 catalog, descriptive of many standard and several new types of hydraulic pumps. This catalog, issued and sent free by The Watson-Stillman Co., 50 Church street, New York, contains valuable information for hydraulic engineers and users of hydraulic machinery.

The Roto Co., Hartford, Conn., have just issued a catalog descriptive of Roto tube cleaners for steam boilers, condensers, heaters, etc. The catalog gives a complete description of the cleaners with excellent wash drawings. The company is engaged exclusively in the manufacture of tube cleaning devices and guarantees the Roto to be thoroughly reliable.

The Albany Lubricating Co., 708-710 Washington street, New York, has just issued a book on "Economic Lubrication," the subject matter of

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which is based on a series of actual tests conducted at Cornell University and the result of which indicated that at all pressures the tallow grease showed a distinctly greater friction-reducing power than greases of the mineral oil type.

The Jerguson Gage & Valve Co., 88 Broad street, Boston, has put out a little catalog on its Reflex water gages and engineering specialties. The Reflex gage is a guard against boiler explosion, as it permits a quick and accurate reading of the water level. The Reflex gage always appears black when full of water and white when empty, making mistakes impossible. The catalog can be had for the asking.

The Ansonia Brass & Copper Co., 90 John street, New York, has just issued a little catalog devoted to Tobin bronze. Tobin bronze is a combination of copper with other metals. When rolled hot it is remarkable for its high elastic limit, tensile strength, hardness and uniform texture. Its tensile and transverse strength is the same as ordinary mild steel, and it is adapted for a variety of purposes where a strong, non-corrosive metal is required. It is especially serviceable for salt water fittings.

The Lagonda automatic cut-off valve, made by the Lagonda Mfg. Co., Springfield, O., is the only valve which has been admitted, up to date, to the museum of safety devices, which is maintained in the Engineering Societies building, 39 West Thirty-ninth street, New York. The valve, as described in recently issued circular matter, is so made as to close automatically if a break occurs on either side of the valve. The circular describes some tests made at Washington in January, 1909, in which a 4-in. valve was used, showing the reliability of the mechanism.

The International Acheson Graphite Co., Niagara Falls, N. Y., has just issued a little booklet entitled "Three Little Stories of Three Big Events and Three Winning Lubricants." The three big events were Beachey's first flight at Niagara Falls, the 500-mile race at Indianapolis and the Vanderbilt cup race. The three lubricants are Oildag, Gredag, and Aquadag. As these three words in themselves are not particularly illuminating, it might be said that Oildag is deflocculated graphite diffused in oil. Gredag is a combination of Acheson-graphite and high grade grease. Aquadag is deflocculated graphite diffused in water, and is intended as an aid in all kinds of metal cutting.

The International Oxygen Co., 68 Nassau street, New York, has just put on the market a booklet descriptive of the I. O. C. system of generating oxygen and hydrogen for cutting, welding and other purposes. The aim of the International Oxygen Co. is to enable a manufacturer to produce his own oxygen and hydrogen. The company is placing on the market I. O. C. system equipments of various capacities, suitable to the individual needs of manufacturers. These plants are simple and reliable, and require no expert attention. The production cost of the gases is practically that of the cost of electric current. The uses to which the flame can be put are innumerable, having a great variety of functions in shipyards, foundries and factories.

The Pocahontas Fuel Co. of Virginia has been awarded contract by the Panama canal commission to furnish 550,000 tons of semi-bituminous coal at $2.51 per gross ton. This coal will be transported to the Isthmus by the Earn line at $1.29½ per ton. The Earn line is British. Too bad this trade, which is essentially coastal, could not be reserved for the American ship.

The navy department has awarded contract to Alexander Miller & Bros., Jersey City, N. J., for a suction dredge to cost $34,950, and to be delivered at the Charleston navy yard.

The New London Marine Iron Works Co., of New London, Conn., has been reorganized and has resumed the operation of its ship yard, machine shop and foundry. The officers are: Edward M. Bradley, New Haven, Conn., president and treasurer; Samuel C. Morehouse, New Haven, vice president and secretary; Wm. H. Narracott, Lyne, Conn., assistant treasurer. Malcolm McNaught will remain as superintendent.

SHIP BUILDING DURING JULY.

The Bureau of navigation reports 143 sail and steam vessels of 15,436 gross tons were built in the United States during July, 1911, as follows:

	Wood. Sail. No.	Sail. Gross.	Steam. No.	Steam. Gross.	Steel. Steam. No.	Steam. Gross.	Total. No.	Gross.
Atlantic and gulf	5	1,566	49	2,333	1	3,063	55	6,962
Porto Rico	..	.....	1	18	..	.....	1	18
Pacific	..	.....	21	465	..	.....	21	455
Great lakes	..	.....	35	372	4	6,895	39	7,267
Western rivers	..	.....	27	724	..	.....	27	724
Total	5	1,566	133	3,912	5	9,958	143	15,436

SUMMARY OF NAVAL CONSTRUCTION.

Name of Vessel.	Building at.	Per cent of completion. 1911. July 1.	Aug. 1.
BATTLESHIPS.			
Florida	Navy Yard, New York	94.3	98.1
Utah	New York S. B. Co.	99.2	99.6
Wyoming	Wm. Cramp & Sons	68.8	70.8
Arkansas	New York S. B. Co.	68.4	71.3
Texas	Newport News S. B. Co.	19.3	24.8
New York	Navy Yard, New York	1.3	2.5
TORPEDO BOAT DESTROYERS.			
Walke	Fore River S. B. Co.	98.7	100.0*
Patterson	Wm. Cramp & Sons	86.0	91.1
Fanning	Newport News S. B. Co.	27.1	33.3
Jarvis	New York S. B. Co.	18.0	23.9
Henley	Fore River S. B. Co.	11.9	13.8
Beale	Wm. Cramp & Sons	33.0	38.2
Jouett	Bath Iron Works	43.5	50.5
Jenkins	Bath Iron Works	34.0	40.3
SUBMARINE TORPEDO BOATS.			
Carp	Union Iron Works	90.0	90.3
Barracuda	Union Iron Works	90.0	90.0
Pickerel	The Moran Co.	85.1	84.9
Skate	The Moran Co.	85.0	85.1
Skipjack	Fore River S. B. Co.	92.4	93.2
Sturgeon	Fore River S. B. Co.	92.4	93.2
Thrasher	Wm. Cramp & Sons	43.0	48.5
Tuna	Newport News S. B. Co.	75.2	77.2
Seal	Newport News S. B. Co.	87.7	88.2
Seawolf	Union Iron Works	34.1	36.0
Nautilus	Union Iron Works	34.2	36.4
Garfish	The Moran Co.	31.1	35.9
Turbot	Lake T. B. Co.	20.1	23.1
Haddock	Fore River S. B. Co.		No report.
Cachalot	Fore River S. B. Co.		No report.
Orca	Union Iron Works		No report.
Walrus	The Moran Co.		No report.
COLLIERS.			
Neptune	Maryland Steel Co.	98.2	100.0
Jupiter	Navy yard, Mare Island		No report.

*Walke was delivered at navy yard, Boston, Mass., July 18, 1911.

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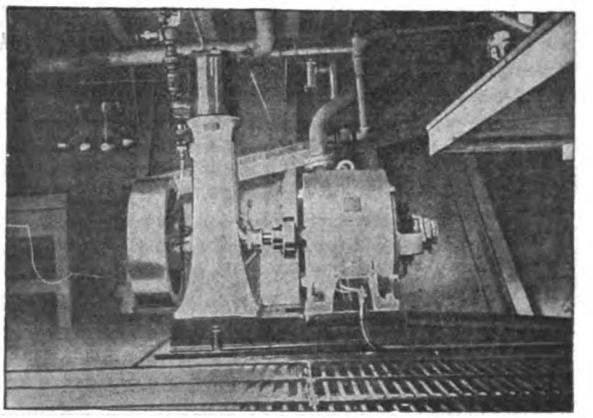

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ACCIDENTS TO LAKE VESSELS

Accidents were quite numerous during the month. There were five total losses and the casualties were quite heavy, 17 persons being drowned. The steamer F. H. Prince caught fire and was beached at Kelley's Island on Aug. 8. Fire again broke out on her on Aug. 12, and she became a total loss. The tug Winslow also burned to the water's edge at Meldrum bay on Aug. 21. The tug C. C. Martin was wrecked on Georgian bay on Aug. 21, drowning 10 of her crew. The barge Albatross, in tow of the Martin, also foundered, but the crew of the barge managed to escape in the yawl. The yacht Gunilda ran on the rocks on Copper island, Lake Superior, and sank in 300 ft. of water after she was released. The steamer Philip Minch had the misfortune to strike the launch Nemo in Toledo bay, drowning seven men.

The most serious accident from a monetary standpoint was the City of Genoa-Gilbert collision. Both were down-bound and went abreast of Sarnia in a dense fog the Gilbert struck the Genoa just after she had thrown out her anchor. The Genoa went down almost immediately in 33 ft. of water. The list tabulated is as follows:

Date.	Name of vessel.	Nature of accident.	Place.
Aug. 3	Str. Thomas Adams	Ran aground in dense fog; released on Aug. 5, after lightering 500 tons of rails; not injured	St. Mary's river.
Aug. 6	Str. Harvey H. Brown	Ran aground near entrance; released on Aug. 7	Buffalo harbor.
Aug. 7	Str. Lambton	Ran aground	Pancake Shoal, near Sault.
Aug. 7	Str. Wm. H. Wolf	Ran aground near T. & O. C. docks; two tugs released her on Aug. 9	Toledo, O.
Aug. 8	Str. F. H. Prince	Caught fire and was beached on Kelley's Island; abandoned to underwriters as constructive total loss; caught fire again Aug. 12 and became total loss	Lake Erie, near Kelley's Island.
———	Str. D. W. Mills	Ran ashore; released	Georgian Bay.
Aug. 8	Str. J. A. Donaldson	While backing out of river, struck an unloading rig on Sheboygan Coal Co.'s dock, tipping it into the river	Sheboygan, Wis.
Aug. 9	Str. Kaministiquia	After leaving her dock, sheered into steamer Ellwood; bow damaged above water line but did not stop for repairs	Above Canadian lock, Soo.
Aug. 9	Str. Isaac L. Ellwood	Hit by steamer Kaministiquia; cut from upper rail down to 10-ft. water mark and her three decks pushed up; repaired at Lorain at cost of $8,000 or $9,000; two weeks required to make repairs; repairs completed Aug. 24	Above Canadian lock, Soo.
———	Sch. Stafford	Struck rock shoal	Lake Michigan, near Gull Island.
Aug. 11	Str. H. W. Smith	Hit an obstruction; damaged outboard shaft and lost wheel; repairs, $2,500	Near Erie dock, Cleveland.
Aug. 12	Bge. Keepsake	Struck a reef; probably will be abandoned by her owners	Off Kelley's Island, Lake Erie.
Aug. 14	Fish tug Pittsburgh	Hit by steamer Western States while she was being towed in; pilot house damaged	Cuyahoga river, Cleveland, O.
Aug. 16	Sch. Atmosphere	Crashed into a bridge; slightly damaged	Port Huron, Mich.
— —	Str. B. F. Berry	Docked at South Chicago Aug. 18 for repairs to her bottom	———
Aug. 18	Fish tug Willard L.	Became disabled; tug Schafer sent after her and towed her to Cleveland	Lake Erie, near Willoughby.
Aug. 18	Fuel ltr. Pittsburgh	Got log in her wheel; diver removed it	Cleveland, O.
Aug. 19	Str. Chicora	Broke her intermediate shaft and engine bed plate; laid up at Toronto, where she was repaired	———
Aug. 19	Str. Case	Leaked very badly and returned to Port Huron; repairs completed Aug. 28	———
Aug. 19	Str. Langdon	While coming out of harbor struck dock of Pacific Dispatch Co., damaging it; steamer not injured	Buffalo harbor.
Aug. 19	Str. Luzon	Struck	South Chicago.
Aug. 20	Str. Key West	Crashed into head gates of Lock 21, carrying away three gates which were badly wrecked; steamer only slightly damaged	Welland Canal.
Aug. 20	Str. Faustin	Steering gear disabled, causing her to sheer, bringing up on rocks and puncturing her bottom; after being released she filled and sank in 16 ft. of water; crew safe	Near Stoney Island, Detroit river.
Aug. 21	Tug Winslow	Burned to water's edge	Meldrum Bay.
Aug. 21	Tug C. C. Martin	Lost in storm, together with crew of 10; wreckage picked up by tug W. M. Oldfield on Aug. 28	Georgian Bay, near Port Au Baril.
Aug. 21	Bge. Albatross	In tow of tug Martin; sank in storm; crew and passengers had very narrow escape	Georgian Bay.
Aug. 22	Str. Warmington	Ran ashore	Near Charlevoix, Lake Michigan.
Aug. 23	Str. North Land	Slightly damaged by fire which started in coal bunkers	Buffalo, N. Y.
Aug. 25	Str. Yosemite	Stuck on bar at entrance to slip; released on Aug. 28 after some dredging was done; will winter at Cleveland with storage cargo of grain	Cincinnati Slip, Cleveland, O.
Aug. 26	Str. City of Genoa	Struck by steamer W. H. Gilbert in dense fog and sank in 33 ft. of water; hit alaft of pilot house; crew escaped on the Gilbert; vessel not insured and loss, including grain cargo, thought to be $100,000; contract for raising her let Aug. 31; grain cargo sold for $13,555	Abreast of Sarnia, St. Clair river.
Aug. 25	Str. W. H. Gilbert	Collided with steamer City of Genoa; hole 3 ft. square in port bow above water line; patched up for Lake Erie trip; 15 plates damaged; in dry dock one week at Toledo making repairs.	Abreast of Sarnia, St. Clair river.
Aug. 26	Barge 137	In tow of steamer Gilbert; slightly damaged; picked up by another steamer and towed to Lake Erie	Abreast of Sarnia, St. Clair river.
Aug. 27	Str. Binghamton	Struck by lightning while lying at dock; top of mast shattered	Erie dock, Buffalo.
Aug. 27	Str. Robert L. Fryer	Ran aground; lightered coal cargo; released on Aug. 28, uninjured	Near Belle Isle, Detroit river.
Aug. 28	Str. Henry Rogers	Struck obstruction	St. Clair river, near Sarnia.
Aug. 28	Str. D. R. Hanna	Struck; docked at Lorain; quite extensive repairs; left dry dock Sept. 6	Near Cray's Reef.
Aug. 29	Tug Dunkirk	Hit by steamer Eastland as she towed her in; hole cut in starboard side; leaked freely; repaired at Cleveland	Cleveland, O.
Aug. 30	Yacht Gunilda	Ran on rocks; after being pulled off, sank, and is total loss	Off Copper Island, Lake Superior.
Sept. 1	Fish tug Charm	Picked up in disabled condition by steamer Sahara; shaft broke	Off Ashtabula, Lake Erie.
Sept. 1	Str. D. Z. Norton	Stranded on rock in thick weather; forepeak and No. 1 tank on port side full of water; released Sept. 4 after part of coal cargo was jettisoned and 2,000 tons lightered; docked at South Chicago; badly damaged	Whitefish Point, Lake Michigan.
Sept. 1	Str. H. W. Smith	Gas buoy at this point was out and the Smith picked same up in her wheel; steamer Leonard in trying to release her ran into her broadside, damaging the Smith's stern; Leonard not hurt; released Sept. 5	Middle Ground, St. Clair river.
Sept. 2	Launch Nemo	Hit by steamer Philip Minch; seven men drowned	Maumee river.
Sept. 6	Tug Burns	Lost her wheel; tug sent to her assistance from Conneaut	Lake Erie, near Conneaut.

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